DEMAND FOR MONEY IN CHINA

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DECLARATION

I certificate that this work has not been accepted in substance for any degree, and is not currently submitted for any degree other than that of Doctor of Philosophy (PhD) of the University of Greenwich. I also declare that this work is the result of my own investigations except where otherwise stated.

06 December 2006

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ABSTRACT

This research investigates the long-run equilibrium relationship between money demand and its determinants in China over the period 1952-2004 for three definitions of money - currency in circulation m_0, narrow money m_1 and broad money m_2. The appropriate dummy variable has been added into the functions to assess and evaluate effects of economic reform in China. The additional influences on money demand in China, such as wages, monetization process and saving effects are explored. The real wage index w, the ratio of urban population to total population *ROP*, the ratio of total deposit to currency *DCR*, and the ratio of total deposit to income *RDG* have been considered as additional variables in the same money demand functions. To test the stable long-run money demand functions, the Engle-Granger two-stage cointegration method (EGTS), Phillips-Hansen cointegration approach, Pesaran *et al.* (2001) ARDL cointegration procedure along with CUSUM and CUSUMSQ stability tests and Johansen Multivariate Cointegration procedures are employed. Granger Causality Test is applied to indicate either uni-directional or bi-directional causality exists in the variables. Wald tests for homogeneity and parameter constancy tests are employed in this study as well.

The estimation results, especially the cointegration analyses show that the real money demand functions perform better than the nominal money demand functions. Narrow money demand m_1 presents more satisfactory coefficients than other two in terms of economic theory and econometric diagnostics. The stabilization policy should primarily aim at the narrow money m_1. This study reveals that the economic reform did bring significant changes to the Chinese economy. Income is shown to be the most important determinant of money demand. The other additional variables also have significant effects on the money demand. The wage index influence on money demand models is important. The raise of monetization process made the money plays a more vital role. The impact of ratio of total deposit to income is significant

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ABBREVIATIONS

ABC – The Agricultural Bank of China

ACF –Autocorrelation Function Approach

ADF–Augmented Dickey-Fuller test

AIC–Akaike Information Criterion

ARDL –Auto Regressive Distributed Lag methods

BOC – The Bank of China

CITIC – China International Trust and Investment Company

CUSUM - Cumulative Sum tests

CUSUMSQ- Cumulative Sum of Squares tests

DC – Developed Countries

DCR – Ratio of Total Deposits to Currency.

ECM – Error Correction Model

EGTS – Engle - Granger Two-stage Cointegration test

GPI – General Price Index

HQC - Hannan-Quinn Criterion

ICBC – Industrial and Commercial Bank of China

LDC – Less Developed Countries

MSI – Monetary Service Index

OLS- Ordinary Least Square

OPI – Official Price Index

PBC – The People's Bank of China

PCBC – The People's Construction of China

PP– Philip and Perron test

RDG– Ratio of Total Deposit to GDP.

ROP – Ration of Urban Population to Total Population.

SBC–Schwarz Bayesian Criterion

SOB–State-Owned Bank

SOE – State-Owned Enterprise

SYBC-Statistical Year Book of China

VAR–Vector Auto regression

Chapter 1 Introduction

The study of money demand is always useful and important and has been a subject for public debate in many countries. In practice, the estimation of the demand for money is a measurement of the demand for real balances. Theories suggested that the demand for real balances is proportional to the level of income and has an inverse relationship with the rate of interest (Laidler, 1993). Demand for money plays a major role in macroeconomic analysis. As commonly agreed, the effectiveness and success of a monetary policy crucially depends on a stable money demand function which ensures the money supply would have predictable impacts on some other economic variables (Driscoll and Ford, 1980). The stability issue in money demand functions becomes an interesting area for researchers to test the effectiveness of monetary programmes.

Numerous studies on relationship between money, financial development and economic growth in China have been well demonstrated by many economists. Because of its special characteristics, China is selected for careful analysis. It is well recognized that Chinese economic reforms feature a dual frame work, in which market-oriented reform is developed progressively whist the traditional planned system continues to function (Yi, 1994). In the two decades prior to economic reform, Chinese economic development was practically static but economic and financial reforms since the late 1970s have brought about major changes in China. The use of monetary policy is being revised and the monetary authorities have much greater responsibilities for keeping a macroeconomic balance. A potential implication of the financial reforms is the increased importance of monetary aggregates in policy making decision (Hafer and Kutan, 1994). China's economic development in the last three decades has not only had great impact on its own economy and development, but also has great effects on the world economy. Although China is still underdeveloped compared with developed countries, monetary control has started to play an increasing role and the research into the demand for money in China is being seriously pursued.

A few previous studies have empirically examined the relationship between money and its determinants. Many have paid some attention to the centralized planned economy in China. The studies from Chow (1987), Yi (1993), Qin (1994), Hafer and Kutan (1994), Huang (1994), Girardin (1996), Arize (2000) and Gu (2004) from different viewpoints demonstrate that a long-run equilibrium relationship exists. However, many studies of money, prices, inflation and other variables still pose a lot of questions. Existing researches are still limited and the empirical results are controversial. Therefore, this study will employ advanced econometric methodologies and improve current literature on money demand in China.

With rapid liberalization of the financial markets and institutional changes, some special features of China's monetary system since reform have become apparent and a few examples are listed below:

- The monetization process accompanied by rapid income increase of both individuals and enterprises has boosted money demand.
- Wages as part of income has changed significantly during the reform.
- Household savings have been sensitive to changes in price levels and interest rates.

These features are of increasing importance on the determinants of money demand and could be considered as possible additional causes of the influences on the money demand.

The main aim of this study is therefore two fold:

1) To determine if there exists a long-run stable relationship between money demand and its determinants in China.

2) To investigate the wider context and find other variables which influence the demand for money in China so as to provide some useful points for analysis and policy making.

The major objectives of this study are as follows:

1) To survey the existing theories.

2) To review some existing empirical works on money demand function in both developed countries (DCs) and less developed countries (LDCs).

3) To analyze some of the existing studies on money demand in China.

4) To offer a general discussion of the Chinese monetary system so as to provide a better understanding of the Chinese monetary system and its institutional changes in recent years.

5) To estimate various money demand functions by using time series techniques.

6) To test the stability of the demand for money in the long-run through a comparison of various estimations in following ways:

- Using real and nominal money demand
- Using three definitions of money: currency in circulation m_0, narrow money m_1 and broad money m_2
- Using dummy variable to check stability of demand for money in the period before and after economic reform.

7) To explore the role of other variables, some of which were neglected in the previous studies. The influences of real wages, the monetization process, and saving effects will be considered as additional influences on the same money demand functions.

8) To explore models of demand for money not previously studied in China and to further investigate the link between money demand and economic activities in China.

The whole thesis is arranged as follows, during which the overall argument is developed.

- Chapter 2 provides a review of relevant literature with a brief analysis of existing theories and empirical studies on money demand in different countries. Empirical research on money demand requires a background on monetary theory. This study will involve a brief review of the theoretical literature of money demand. The simple versions of the quantity theory will be followed by the Keynesian theory of liquidity preference and then by more modern variants. As theory evolved, so did empirical research. In recent years, further empirical investigations of the demand for money functions for the long-run and short-run have been provided by many economists. Sriram (2001) provided a comprehensive survey of the empirical literature on demand for money in various countries. Sriram has summarized the major features of previous studies and presented relevant information in a comparable framework to promote easy understanding of the approaches used. Our study intends to extend Sriram's early work in the same format to survey more recent studies in both developed and developing countries for comparison.

- Chapter 3 consists of an analysis and discussion of the monetary system before and after economic reforms in China. The discussion will concentrate on various aspects of monetary performance and indicate the possible factors affecting money demand in China. The demand for money plays an important role in the literature of the monetary theories. The historical outline about Chinese monetary system is necessary. However, because China was largely locked into a planned economy in the past, some of the theories employed in developed countries will not suitable for use in the Chinese economy. Therefore, a brief survey of the factors which influenced monetary control in China over the period 1952-2004 is necessary and a review of more recent developments in the economy will be included.

- Chapter 4 estimates various money demand functions by using time-series econometric techniques on the annual data over the period 1952-2004 in China. Empirical estimation of a money demand function requires choosing explicit variables measuring both money and its determinants. The theoretical approach defines money by using economic theory to decide which assets should be included in its measure. Many previous studies cover the sample period only to the 1990s and monetary aggregates mostly considered were narrow money m_0 or broad money m_2 or both. However, in the last decades, there have been profound changes in money demand and monetary policy in China. Therefore, this study intends to employ more definitions of money including m_0, m_1 and m_2 to check all the influences. The time period over 1952-2004 was chosen entirely because of availability of relevant data on the Chinese economy. The econometric advances in the last two decades, especially in the case of cointegration techniques, have enabled researchers to test more vigorously the stability issue of money demand functions. The stabilization policy should aim at those components of money which are cointegrated with all the explanatory variables. To achieve this objective, the current study will employ both single and multivariate cointegration procedures along with the stability tests. Recent advanced technique will be employed. To determine the order of integration, three procedures suggested by Autocorrelation Function Approach (ACF), Augmented Dickey-Fuller (ADF) test (Dickey and Fuller, 1981) and Phillip-Perron (PP) test (Phillip and Perron, 1988) will be applied. Each of these will be considered in turn. To test the stable long-run money demand functions, the Engle-Granger two-stage cointegration method (EGTS), Phillips-Hansen cointegration approach, Pesaran *et al.* (2001) ARDL cointegration procedure along with CUSUM and CUSUMSQ stability tests, Johansen Multivariate Cointegration (Johansen and Juselius, 1990) procedures and Error Correction Model (ECM) will be employed. Granger Causality Test will be applied to indicate uni-directional or bi-directional causality in the variables. Wald tests for homogeneity and parameter constancy tests will be used as well. Through various estimations, the aim is to find out a more appropriate money demand function in China and provide useful indication for policy making.

- Chapter 5 constitutes the core estimations of new models using the additional variables. The conventional study of money demand in China is based on a frame-work which suggests that money demand is generally determined by some scale variables such as income and opportunity cost like the domestic interest rate. However, many economic factors have now become very important in the determination of money demand. Therefore, this study intends to ascertain the influences of other variables and try to provide greater insights regarding the nature of money demand behaviour in the Chinese economy. The real wage index w, the ratio of urban population to total population ROP, the ratio of total deposit to currency DCR, and the ratio of total deposit to income RDG will be considered as additional variables in the same money demand functions. The methodologies will be using the same techniques mentioned above in Chapter 4.

- Chapter 6 provides a summary and conclusion of the study.

The contributions and innovation of our research are listed below.

1) Our study extends the data of the previous research to 2004, which is the most update information that one can gather from the Chinese economy.

2) Our study makes various estimations and extends the existing empirical works on the money demand function in China.

3) Our study employs one of the most recent single cointegration technique, namely: Pesaran *et al.* (2001) which has not been used in the previous money demand estimations in China.

4) Our study explores and uses a few additional variables like real wages, monetization, urbanization and saving effects to establish the empirical suitability of the demand for money function for the Chinese economy.

5) Our study provides helpful information for appropriate monetary policy making.

Unlike previous research, this study provides more consideration in terms of different variables, models and methodologies in order to arrive at more accurate estimations of money demand functions in China. The full empirical results are shown in the tables of each section in Chapter 4 and 5. The detailed reports of the estimates of these models are available in the Appendix section of the attached CD-ROM.

Chapter 2 Literature Review

2.1 Introduction

The objective of this chapter is to provide an analysis of the existing theories and empirical studies of money demand. Macroeconomics defines money as a medium of exchange, a store of value, a unit of accounting and a source of deferred payment. There have been engaged vast econometric estimations and discussions of money demand relationship in many countries in the world. The significance of money demand study is well recognized by both economists and researchers when designing monetary policy. The relationship between the demand for money balances and its determinants is a fundamental building block in most theories of macroeconomic behaviour. Indeed, a stable demand function for money has long been perceived as a prerequisite for the use of monetary aggregates in the conduct of monetary policy.

This chapter is divided into five sections. The second section will provide a brief review of theories of money demand. The third section will outline a review of empirical literature on the studies of money demand of recent years in both developing and developed countries. The fourth section will make comparison of various money demand studies in China to investigate the further relationship between money demand and economic activities. The fifth section will provide a summary and conclusion.

2.2 Theories of Money Demand

The classical theory of demand for money of Quantity theory shows that changes in the level of the stock of money would change the general level of prices (Fisher, 1911). The Cambridge equation from the work of Pigou (1917) develops and improves Fisher's early approach and considers the various factors which influence an individual's expectations to hold money. However, classical theories only emphasize the transactions demand and assume that the economy is at a full employment level. Two main approaches to the theory of demand for money were developed by Keynes (1936) and Friedman (1956). Keynes (1936) looks at the functions of money and suggests three motives - the transactions motive, the precautionary motive and the speculative motive. Keynes' analysis of demand for money leads to conclusions which are opposite to those of Fisher's and represents a development of the earlier Cambridge theory. Quantity theory by Friedman (1956) specifies various roles of money. Money is a representative asset. Friedman's work moves attention away from the motives of people to hold money. Friedman needs a theory for the determination of nominal income. The quantity theory is in the first instance of 'the demand for money' (Friedman, 1956). While the original Keynesian theory emphasizes the distinction between the transactions demand depending on real income and speculative demand depending on the rate of interest; Baumol (1952) and Tobin (1958) attempted to link the three motives and show that transactions demand also depends inversely on the real rate of interest. Earlier evidence suggested that a few variables, essentially income and interest rates were capable of providing a plausible and stable explanation of money demand. Mundell (1963) provided an introduction of the exchange rate into the money demand relationship and introduced an open economy model to assess the effects of fiscal, monetary and exchange rate polices in a world with ever increasing capital mobility.

2.3 Econometric Literature

Numerous studies in the past have empirically examined the money demand functions in both developed and developing countries. In recent years, further empirical investigations of the demand for money functions for the long-run and short-run have been provided by many economists. The empirical literature on money demand function in less developed countries provides little that is new in the way of approaches to the problem of estimation compared with the amount of equivalent work undertaken for developed countries (Ghatak, 1995). Sriram (2001) has provided a comprehensive survey of the empirical literature on demand for money in various countries. Sriam's work surveys a selected number of papers that applied the error correction model (ECM) approach to analyze the demand for money of various definitions. Sriram has summarized the major features of previous studies and presented relevant information in a comparable framework to promote easy understanding of the approaches followed, variables included and coefficients derived (Sriram, 2001). However Sriram examines the work produced until the end of the 1990s. In this study, we will extend Sriram's survey to examine more recent money demand studies in both developed and developing countries using the same framework as Sriram's.

Table 2.1 presents details relevant to modelling and estimating the demand for money of recent year's studies. Table 2.2 summarizes the long-run coefficients from those studies listed in Table 2.1.

Table 2.1 Summary of Recent Demand for Money Studies in Developing and Developed Countries

Country/Authors	Sample Period/ Frequency	Monetary aggregate	Determinants: Scales variables	Determinants: Interest rates	Determinants: Others	Unit root test	Cointegration techniques	Stability Tests	ECM	Findings
Industrial Countries										
German Beyer (1998)	1975-1994 (quarterly)	Real m_3	Real GDP	RS &RL	Annual inflation	ADF	J (1988)	Tests for Parameter Instability	Yes	An empirically stable money demand model for M3 is presented. There is evidence that inflation and long-term interest rates are super-exogenous with respect to the parameters of the demand for M3 model.
German Lutkepohl, Terasvirta and Wolters (1999)	1961-1990 (quarterly)	Real m_1	Real GDP per capita	Nominal	Inflation	ADF	J (1995)	Parameter Constancy Tests	Yes	It is found that the money demand equation considered is both linear and stable. After extending the sampling period until 1995, a clear structural instability due to the monetary unification in 1990 is found and subsequently modelled.
Greece Karfakis (2002)	1948-1997 (annual)	Nominal m_1 & m_2	Nominal income			Perron, Zivot and Andrews (1992)	ARDL	CUSUM	Yes	This paper tests two monetarist hypotheses on Greek data: 1). The predictability of income velocity. 2). The proportionality postulate between nominal income and money.

Table 2.1 (Continued)

Country/Authors	Sample Period/ Frequency	Monetary aggregate	Determinants			Unit root test	Cointegration techniques	Stability Tests	ECM	Findings
			Scales variables	Interest rates	Others					
Italy Muscatelli and Spinelli (2000)	1861-1996 (annual)	Real m_2	Real income	*rl* & *rs*	INF	ADF	Phillips-Hansen (1990) DOLS	-	Yes	Demand for broad money to be remarkably stable, despite periods of considerable economic turbulence.
Japan Nagayasu (2003)	1958-2000 (quarterly)	Nominal m_2+CD	Real income	Nominal	-	-	Phillips-Hansen (1990)	Hansen (1992)	-	A simple relationship between money and income and interest rate is insufficient for analyzing the effects of current Japanese monetary policy.
Japan Jayaraman (2003)	1980-2001 (quarterly)	Nominal m_2 and MB	-	-	-	ADF	J (1995)	-	-	Money multiplier appears to be of no policy relevance for small island economies in the pacific.
Japan Rao and Singh (2004)	1971-2002 (annual)	Real m_1	Real GDP	Nominal	-	ADF&PP	GTS (Hendry) J (1988)	TIMVAR CUSUM & CUSUMSQ	Yes	There is a well determined stable demand for money in Fiji from1971-2002.

Table 2.1 (Continued)

Country/Authors	Sample Period/ Frequency	Monetary aggregate	Determinants			Unit root test	Cointegration techniques	Stability Tests	ECM	Findings
			Scales variables	Interest rates	Others					
Russia Bahmani-Oskooee and Barry (2000)	1991-1997 (monthly)	Real m_2	Real income		π -Inflation &Exchange rate	ADF	JJ (1990)	CUSUM CUSUMSQ Hansen & Johansen (1993)	Yes	This paper estimate money demand in Russia. It combines CUSUM and CUSUMSQ test for stability of estimated coefficients conjunction with cointegration and ECM model techniques to test short-run and long-run CI vector. It is shown that the Russsian money demand is unstable.
Spain Bahmani-Oskooee, Martin and Niroomand (1998)	1974-1992 (quarterly)	Real m_1 Real m_2	Real income	Nominal	Nominal exchange rate	ADF	JJ (1990)	Hansen-Johansen	Yes	Inclusion of the nominal effective exchange rate improves the M2 money demand formulation but not M1. Hansen-Johansen test for constancy shows the exchange rate was shown to be stable for M2.

Table 2.1 (Continued)

Country/Authors	Sample Period/ Frequency	Monetary aggregate	Determinants: Scales variables	Determinants: Interest rates	Determinants: Others	Unit root Test	Cointegration techniques	Stability Tests	ECM	Findings
Sweden Hacker and Hatemi-J (2005)	1969-2001 (quarterly)	Real m_1	Real GDP	Nominal short-run rate		Perron test (1989)	Gregory and Hansen (1996)	-	-	The estimated elasticities show that money demand is more responsive to its determinants in the period after structural break than before.
UK Berument and Froyen (1998)	1957-1993 (quarterly)	Real m_2, m_4	Real GDP	R_B, R_L, R_C		ADF PP S &W	Jahansen's Lambda max and trace tests	-	-	The relationship between traditional monetary policy goal variables –nominal GDP, real GDP and inflation rate) and a number of financial market variables is investigated.
Developing countries										
Bangladesh Siddiki (2000)	1975-1995 (annual)	Real m_2	Real income per capita	Nominal domestic & foreign interest rate	-	-	ARDL	-	Yes	There is a unique cointegrated and stable long-run relationship among real per capita broad money demand and its determinants.

Table 2.1 (Continued)

Country/Authors	Sample Period/ Frequency	Monetary aggregate	Determinants: Scales variables	Determinants: Interest rates	Determinants: Others	Unit root Test	Cointegration techniques	Stability Tests	ECM	Findings
Dominican Public Carruth and Sanchez-Fung (2000)	1950-1996 (annual)	Nominal m_1	Real GDP	Nominal long-term bond rate	Real black market exchange rate	ADF	J (1988) JJ (1990)	-	Yes	A long-run demand for money relationship is developed from the perspective of alternative estimation methodologies, and it is shown that a literature standard specification augmented by foreign monetary variables is robust. The short-run dynamic model is adequate, stable and suggests an important role for inflation and exchange rate with the USA.
Eight LDCs Arize (2005)	1973-1999 (quarterly)	Real m_2* (desired real money balances)	Real GDP	Market rate of interest	Inflation σ_{1t} & σ_{2t}	ADF	J (1995) Park and Choi (1988)	Hansen (1992)	Yes	Inflation-rate volatility plays a statistically significant role in the demand for money in LDCs.

Table 2.1 (Continued)

Country/Authors	Sample Period/ Frequency	Monetary aggregate	Determinants			Unit root test	Cointegration techniques	Stability Tests	ECM	Findings
			Scales variables	Interest rates	Others					
Hungary and Poland Buch (2001)	1991-1998 (monthly)	Real m_1&m_2 for Poland Nominal m_1&m_2 for Hungary	Nominal income	Domestic & Foreign interest rate	Domestic inflation	DF		Hansen (1993) Tests on Parameter Stability	Yes	The results suggest that long-run parameters are in line with economic theory. Money demand functions can serve as a useful reference for monetary authorities.
India Rao and Singh (2003)	1953-2002 (annual)	Real m_1	Real GDP	Nominal	-	ADF	JJ (1990)	TIMVAR	Yes	There is a stable money demand in India between1953-2002, but there was a shift from demand towards time deposits during 1979-1983
India Ramachandran (2004)	1951-2001 (annual)	Nominal m_3	Output	-	-	PP	JJ (1990) Gregory & Hansen (1996)	CUSUM & CUSUMSQ Recursive (Chow test)	-	There exist a fairly stable relationship among M3, output and prices. The short-run must be handled with caution.

Table 2.1 (Continued)

Country/Authors	Sample Period/ Frequency	Monetary aggregate	Determinants			Unit root test	Cointegration techniques	Stability Tests	ECM	Findings
			Scales variables	Interest rates	Others					
Korea Hwang (2002)	1973-1997 (quarterly)	Real m_1 Real m_2	Real GDP	Nominal long-term short-term	-	ADF	J (1988) JJ (1990)	CUSUM & CUSUMSQ	Yes	There is a long-run equilibrium relationship between M2 and its determinants, but not for M1.
Latin-America Prock, Soydemir and Abugri (2003)	1986-2001 (monthly)	Real m_1	Real income	Nominal interest on alternative assets	Nominal Exchange rate	ADF	J (1988)	-	Yes	Currency substitution occurs more in Argentina and Brazil than Mexico perhaps Mexico have more successful economic policies implanted after Dec.1994 crisis.
Malaysia Sriram (1999)	1973-1995 (monthly)	Real m_2		TD3R & TB3MR	LIP90, USTB3MR DEPR, Dummy	ADF DF	J (1988) JJ (1990)	Chow & Parameter constancy tests	Yes	The demand for M2 is fairly stable with its determinants in both long-run and short-run.
Nigeria Akinlo (2005)	1970-2002 (quarterly)	Real m_2	Real income	Nominal	Nominal exchange rate	-	Pesaran *et al.* (2001)	CUSUM & CUSUMSQ	Yes	M2 is cointegrated with income, interest rate and exchange rate. The result revealed the stable relation in the CUSUM test.

Table 2.1 (Continued)

Country/Authors	Sample Period/ Frequency	Monetary aggregate	Determinants			Unit root test	Cointegration techniques	Stability Tests	ECM	Findings
			Scales variables	Interest rates	Others					
Seven-Asian Countries Bahmani-Oskooee and Rehman (2005)	1973-2000 (annual)	Real m_1 Real m_2	Real income	-	Inflation & Exchange Rate	-	Pesaran *et al.* (2001)	CUSUM & CUSUMSQ	Yes	In some Asian countries, (India, Indonesia, Malaysia, Pakistan, Philippines, Singapore, and Thailand), even though real M1 or M2 are cointegrated with their determinants, the estimated parameters are unstable.
South Africa Nell (2003)	1968-1998 (annual)	Nominal m_3	Real income	Nominal RM & RO	-	ADF PP	EGC (1987) Pesaran *et al.* (2001) JJ (1990)	Chow	Yes	This study presents empirical evidence of a constant and structurally stable M3 money demand function in South Africa. The money stock is endogenous with price determining money through M3
Thailand Bahmani-Oskooee and Techaratanachai (2001)	1977-1990 (quarterly)	Real m_2	Real income	Nominal	Nominal exchange rate	ADF	JJ (1990)	-	-	Macro policies in Thailand must aim at not only stabilizing the economy, but also at stabilizing the exchange value of the Thai baht.

Table 2.1 (Continued)

Country/Authors	Sample Period/ Frequency	Monetary aggregate	Determinants			Unit root test	Cointegration techniques	Stability Tests	ECM	Findings
			Scales variables	Interest rates	Others					
Turkey Halicioglu and Ugur (2005)	1952-2002 (annual)	Real m_1	Real income per capita	Nominal	Nominal exchange rate	-	Pesaran *et al.* (2001)	CUSUM & CUSUMSQ	Yes	There is a stable money demand function and it could be used as an intermediate target of monetary policy in Turkey.
Turkey Akinci (2003)	1987-2003 (quarterly)	Real cash balances	Real private consumption expenditure (PCONr)	RTB	Nominal exchange rate	ADF	J (1988) JJ (1990)	Chow	Yes	Long-run demand for real cash balances depends on real income, interest rate on government securities and exchange rate.

Table 2.1 (Continued)

Country/Authors	Sample Period/ Frequency	Monetary aggregate	Determinants			Unit root test	Cointegration techniques	Stability Tests	ECM	Findings
			Scales variables	Interest rates	Others					
Turkey Civcir (2003)	1987-1999 (monthly)	Real broad money	Real income	Rd, Rb,	s^e, Rf, π	ADF	J (1988) JJ (1990)	-	Yes	Long-run demand for real balance depends upon real income, its own interest rate, interest rats of government securities and exchange rates. Demand for broad money is stable.

Notes: J (1988) – Johansen (1988). RS-short-term interest rate. RL-long-term interest rate. JJ (1990) – Johansson and Juselius (1990), J (1995) – Johansen Multivariate cointegration procedures (Johansen, 1995), rl represents the yield on long-term government debt. rs represents the average rate on bank deposits as a measure of the own rate for M2. CD represents certificate deposits. MB represents monetary base, where MB consists of commercial banks' reserve kept with the central bank and currency held with public. R_B- is the treasury bill rate. R_L is the loan rate. R_C is the call money rate. PP-Phillips and Perron (1988). S & W-Stock and Watson (1988). σ_{1t} is the inflation-rate volatility variable for the first system, σ_{2t} is the inflation rate volatility variable for the second system. TD3R – Interest on 3 month time deposits, TB3MR- discount rate on 3month treasury bills, LIP90-industrial production index, USTB3MR-yield on 3 month treasury bill, DEPR-annualized exchange rate depreciation. RM is opportunity cost of holding money, and RO is the own rate of return. RTB is the interest rate on government securities. Rd- is interest rates on government securities, Rb is the interest rates on lira deposits, s^e is expected rate of change in exchange rate, Rf is the foreign interest rates. nc -notes and coin in circulation outside the banking sector. PCONr represents private consumption expenditure. FR is foreign interest rate. EX is exchange rate.

Table 2.2 Summary of Coefficients of Long-run Demand Money Studies in Developing and Developed Countries

Authors	Sample Period/ Frequency	Money	Elasticity: Real income	Interest rate	Inflation	Others
Industrial countries						
German Beyer (1998)	1975-1994 (quarterly)	Real m_3	0.936	1.61 (RS) -3.279 (RL)	-1.78	
German Lutkepohl, Terasvirta and Wolters (1999)	1961-1990 (quarterly)	Real m_1	1.12	-5.11		
Greece Karfakis (2002)	1948-1997 (annual)	Nominal m_1 & m_2	0.98 for m_1			
Italy Muscatelli and Spinelli (2000)	1861-1996 (annual)	Real m_2	1.813 DOLS	-14.10 (rl) 9.94 (rs)	0.349	
			1.791 Phillips-Hansen	-13.08 (rl) 10.17 (rs)	-0.003	
		Nominal m_2	1.937 DOLS	-19.01 (rl) 12.80 (rs)	0.235	
Japan Nagayasu (2003)	1958-2000 (quarterly)	Nominal m_2 + CD	1958-1985 1.247 1958-1989 1.270 1958-1993 1.299 1958-2000 1.299	-0.006 0.011 -0.009 -0.015		
Japan Rao and Singh (2004)	1972-2001 (annual)	Real m_1	1.13 J (1988)	-0.041		
Russia Bahmani-Oskooee and Barry (2000)	1991-1997 (monthly	Real m_2	2.46		-4.09	-0.18 (exchange rate)
Sweden Hacker and Hatemi-J (2005)	1969-2001 (quarterly)	Real m_1	before break, 0.273 after break, 0.441	-0.008 -0.122		
Developing countries						
Bangladesh Siddiki (2000)	1975-1995 (annual)	Real m_2	3.26	0.08 (r^d) -0.145 (r^f)		
Dominican Public Carruth and Sanchez-Fung (2000)	1950-1996 (annual)	Nominal m_1	1.043	-0.047	-0.547	0.648 (black market exchange rate)

Table 2.2 (Continued)

Authors	Sample Period/ Frequency	Money	Real income	Elasticity Interest rate	Inflation	Others
Eight LDCs Arize (2005)	1973-1999 (quarterly)	Real m_2* (desired real money Balances)	First system ($m, y, r\ \sigma_{1t}$)			
			Indonesia 2.29	-0.090	-0.66	
			Kenya 1.41	0.043	-1.09	
			Malaysia 1.47	-0.053	-12.31	
			Mexico 1.92	-0.010	-0.45	
			Philippines 2.52	-0.029	-0.55	
			South Africa 1.05	-0.030	-0.47	
			Singapore 1.10	-0.020	-4.20	
			Thailand 1.46/1.38	-0.05/-0.08	-0.78/0.53	
Eight LDCs Arize (2005)	1973-1999 (quarterly)	Real m_2* (desired real money Balances)	Second system ($m, y, r\,\sigma_{2t}$)			
			Indonesia 2.33	-0.08	-0.32	
			Kenya 0.91	0.030	-0.34	
			Malaysia 1.60	-0.029	-0.06	
			Mexico 2.27	-0.010	-0.24	
			Philippines 2.72	-0.030	-0.30	
			South Africa 1.25	-0.018	-0.07	
			Singapore 1.70	-0.040	-0.003	
			Thailand 1.56	-0.010	-0.26	
Hungary and Poland Buch (2001)	1991-1998 (monthly)	Real m_1 & m_2	Poland			
			1.14 (Real m_2)	0.003		
			0.95 (Real m_1)			
			Hungary			
			0.95 (m_2)	-0.002	-0002	
			0.55 (m_2)	-0.001	-0.04	
India Rao and Singh (2003)	1953-2002 (annual)	Real m_1	1.185	-0.23		
India Ramachandran (2004)	1951-2001 (annual)	Nominal m_3	1.06 (for output)		1.53	
Korea Hwang (2002)	1973-1997 (quarterly)	Real m_1 Real m_2	0.69 (m_2)	-0.08 (m_2)		
Malaysia Sriram (1999)	1973-1995 (quarterly)	Real m_2		TD3R	INF	TB3MR
			1.036 J (1988)	4.884	-4.745	-5.391
			1.130 JJ (1990)	2.510	-4.891	-1.834

Table 2.2 (Continued)

Authors	Sample Period/ Frequency	Money	Real income	Elasticity Interest rate	Inflation	Others
Nigeria Akinlo (2005)	1970-2002 (quarterly)	Real m_2	1.095	-0.097		0.008 (exchange)
Seven-Asian Countries Bahmani-Oskooee & Rehman (2005)	1973-2000 (annual)	Real m_1 Real m_2	m_1 / m_2 India 0.55 / -3.83 Indonesia 1.29 / 3.92 Malaysia 1.20 / 1.25 Pakistan 0.86 / 0.58 Philippines 0.30/ 1.13 Singapore 0.73/1.48 Thailand 0.14/0.90			EX m_1 / m_2 0.27 / 3.49 0.65/ 0.32 -0.64/-0.75 -0.15/ 0.34 -0.04/-1.09 -0.52/ 0.46 2.57/-0.76
South Africa Nell (2003)	1968:1998	nominal m_3	1.48 EGC 1.58 Pesaran *et al.* 1.56 JJ (1990)		0.94 0.92 0.93	
Thailand Bahmani-Oskooee & Techaratanachai (2001)	1977-1990 (quarterly)	Real m_2	1.20	-0.12		0.62
Turkey Halicioglu & Ugur (2005)	1952-2002 (annual)	Real m_1	0.939	-0.13		-0.064 (for ER)
Turkey Akinci (2003)	1987-2003 (quarterly)	Real cash balances	0.85 (PCONr)	-0.284 (RTB)		-0.051
Turkey Civcir (2003)	1987-1999 (monthly)	Real broad money	1.009	-13.393 (Rb) 17.613 (Rd)	-31.333 (π)	-1.461 (s^e)

Notes: r^d represents domestic interest rate, r^f represents foreign interest rate. TD3R – Interest on 3 month time deposits. TB3MR- discount rate on 3month treasury bills. ER is exchange rate. PCONr represents private consumption expenditure. FR is foreign interest rate. EX is exchange rate. RTB is the interest rate on government securities. Rd- is interest rates on government securities, Rb is the interest rates on lira deposits

The preceding literature review shows that the money demand functions in many countries have been estimated using various aggregates. Scale variables which represent the transactions or wealth effects are positively related to the demand for money. The opportunity cost variables such as foreign interest rates and expected exchange depreciation are widely considered and expected to have a negative effect on money demand. Sriram (2001) concluded that the extensive literature underscores two major points relevant to modeling and estimating the demand for money: variable selection and representation and the framework chosen. According to previous studies, the independent variables in the demand for money function could normally fall into three groups – the scale variables, the opportunity cost variables and other variables. In the real sector of the economy, other variables play a role in the demand for money function and some but not all of these influences have been considered in a number of studies above. In terms of the methodologies, many studies employed Johansen (1988) and Johansen and Juselius (1990) cointegrating techniques to exam the long-run relation between demand for money and its determinants. A number of studies have applied Pesaran *et al.* (2001) and stability tests. In applying the cointegration technique, it is necessary to determine the order of cointegration of each variable. As noted in the literature, depending on the power of the unit root tests, different tests will yield different results. In view of these problems, the single cointegration method proposed by Peseran et al. (2001) appears to emerge more in empirical studies of money demand functions. This method has a number of econometric application advantages over the previous cointegration techniques. (See examples of Bahmani-Okskooee and Ng 2002; Akinlo, 2005; Halicioglu and Ugur, 2005). In general, studies of demand for money functions for LDCs indicate that stability functions can be estimated in the same lines as constructed for DCs. From the above analysis, the studies relating to LDCs have yielded additional evidence on the role of money demand and its determinants and provided a useful framework for research in China.

2.4 The literature on Money Demand in China

China has special features compared with above different countries. Since China was largely locked into a planned economy in the past, some of the theories and examples may not have been employed in the Chinese system. From a general point of view, Chinese economic development can be separated into two periods: before and after economic reform. During the two decades prior to economic reform, the Chinese economy was under the control of central planning system. The third meeting of the Eleventh Central Committee held in 1978 can be regarded as the starting point of Chinese economic reform. After which many reforms of the whole economic system were carried out. China's financial sector reform comprise mainly of two important and interrelated aspects: reforming the existing financial institutions and creating new financial institutions, instruments and markets (Shang, 1998). In the 1990s, a more comprehensive reform was implemented focusing on the commercialization of state-owned banks (SOBs). China has made dramatic changes in the macroeconomic and monetary conditions in recent years and experienced several stop-go and economic fluctuation. Each economic fluctuation was mainly brought about by economic overheating and retrenchment during these market reforms.

The empirical work on money demand in China was started by Chow (1987). During1983-1984, the currency in circulation in China increased about 50% as a result of the monetary policy allowing individual banks to extend credit without establishing a mechanism of monetary control by the central bank. The possible effect of this increase in money supply on inflation became an important issue for Chinese economic reform in 1985. Chow's work on money and price level determination in China attracted theoretical interest over the world as well as being of relevance to price reforms in China. Chen (1989) investigated causal relationships between three alternative monetary aggregates and four indicators of macroeconomic performances – economic development, budget deficit, trade deficit and price stability in mainland China. In Chen's analysis, a causal relationship existed between currency and nominal income, currency and budget deficit and currency and trade deficit. One way causality existed between currency and total inflaton. Hence, it can be concluded that around the 1980s, currency was the best target for monetary policy (Chen, 1989). Yi (1993)'s empirical evidences indicated that the demand for money in China changed significantly before and after economic reform. In Yi's study, the measure of the opportunity cost of holding money was omitted. This was because during the period of 1952-1988 in China, interest rates had been strictly controlled and virtually fixed at a level far below the equilibrium level. A few studies also omitted the interest rate for the same reason. It would be natural to include the inflation expectation in Yi's model as an explanatory variable. According to Yi, the official retail price level was virtually frozen during the period 1952-1978 and the market price level was also relatively stable before the economic reform, so it is fair to say that the inflation rate was extremely low during that period. Yi (1993) suggested that the growth rate of money supply should accommodate both GDP growth and the monetization process, as each important reform step is associated with a monetization consequence (Yi, 1993). Qin (1994) surveyed the money demand function in China and was particularly concerned by the effects of economic reform. Qin (1994) tried to find an economically meaningful money demand function with relatively constant coefficients on the basis of the belief that any empirical results worthy of economic interpretation must exhibit certain degrees of parameter constancy. Girardin (1996) discussed the question about 'Is there a long-run demand for currency in China? '. The record of Chinese monetary authorities at targeting m_0 in the late eighties and early nineties was rather poor. Girardin (1996)'s research aims at determining whether the instability of currency demand is responsible for this. The results show that using adequate economic econometric techniques a long-run demand for currency did exist over the period of 1988-1993 with quarterly data. Another objective of Girardin's paper was to test for the robustness of the result. Because most previous studies concluded that income elasticity of currency demand was very high, Girardin's work showed that the income elasticity is unity when proper account is taken of institutional variables representative of the transition process. Yu and Tsui (2000) constructed a monetary Services Index (MSI) for China. Compared to the traditional simple money aggregates, this index has solid microeconomic foundations and has consistent variables. More recent study from Gu (2004) revealed that a stable long-run money demand function for both narrow and broad money exists in China over the period 1952-2000. However, Gu (2004) found there is a couple of weaknesses in structural break test. To arrive at a better understanding about the money demand in China, Table 2.3 and 2.4 summarizes the results of some previous studies of demand for money in China. Table 2.3 presents details of relevant to modeling and estimating the demand for money in China. Table 2.4 summarizes the long-run coefficients from those studies listed in Table 2.3.

Table 2.3 Summary of Demand for Money Studies in China

Authors	Sample Period/ Frequency	Monetary aggregate	Determinants Scales variables	Interest rates	Price index	Others	Unit root test	Cointegration techniques	Stability Tests	ECM	Findings
Chow (1987)	1952-1983 (Annual)	Real m_0	Real GNP	-	RPI	-	-	-	-	-	The quantity theory provides useful point to explain price level in China.
Burton and Ha (1990)	1983-1988 (Quarterly)	Household Money balances	Real GNP	-	RPI	Inflation RPI based.		EGC	-	-	Inflation is included as explanation variables
Yi (1993)	1952-1989 (Annual) 1983-1989 (Quarterly)	Real m_2 Real m_2	Real GNP	-	OPI & MPI	UP Dummy	DF	-	-	-	Economic reform and monetization process influence money demand significantly
Tseng Et al (1994)	1983-1988 1989-1993 1983-1993 (Quarterly)	Real m_1 Real m_2	Real national income	-	RPI	Inflation RPI based	ADF	EGC J (1988) JJ (1990)	Chow	Yes	All monetary aggregate are sensitive to inflation. Interest rate has significant influence on m_1 and m_2.

Table 2.3 (Continued)

Authors	Sample Period/ Frequency	Monetary aggregate	Determinants Scales variables	Interest rates	Price index	Others	Unit root test	Cointegration techniques	Stability Tests	ECM	Findings
Qin (1994)	1952-1991 (Annual) 1978-1991 (Quarterly)	m_0 deflated by NID	GDP GNP	Real	-	IM&RSL	DF ADF	J (1988)	-	Yes	Monetization index, and economic reform are considered as significant influence. A constant relation of money demand can be found.
Huang (1994)	1979-1990 (Annual)	Real m_2	Real GNP	Real	CPI	-	ADF	EGC JJ (1990)	Chow	Yes	Long-run relationship exists between money demand and its determinants.
Hafer and Kutan (1994)	1952-1983 (Annual)	Real m_0 Real m_2	Real GNP	Real	RPI DEF	-	DF	J (1988) JJ (1990)	-	Yes	Cointegration relation exists only when national income deflator is used as a price variable
Girardin (1996)	1988-1994 (Quarterly)	Real m_0	Nominal GNP	-	RPI	ρ	ADF	J (1988)	-	-	A long-run demand for currency did exist over 1988-1994.

Table 2.3 (Continued)

Authors	Sample Period/ Frequency	Monetary aggregate	Determinants Scales variables	Interest rates	Price index	Others	Unit root test	Cointegration techniques	Stability Tests	ECM	Findings
Arize (2000)	1952-1994 (Annual)	Real m_0 Real m_2 Real m_3	Real income	Nominal	RPI	σ	ADF	JJ (1990) Phillips & Hansen	-	Yes	Inflation exert a significant effect upon money demand in short-run and long-run.
Gu (2004)	1952-2000 (Annual) 1982-200 (Quarterly)	Real m_0 Real m_2	RGDP	Real	RPI DEF	-	ADF	J (1991) DOLS Gregory and Hansen 1996)	-	Yes	There exist long-run money demand functions in China over 1952-2000.

Notes: RPI – Retail price index, CPI- Consumer price index, OPI – Official price index, MPI- Free market price index, NID- National income deflator, IM- 0.5RP+0.RO (RP: ratio of agricultural output deflator to industrial output deflator, RO: ratio of non-state-owned industrial output to total industrial output. RSL- annual rates of the ratio of total bank savings to total loans. UP- Urban population to total population. See Qin (1994). DEF- National income deflator. ρ is the difference of the logarithms of industrial production in the non-stat sector and in the state sector. σ is the logarithms of the inflation. DF- Dickey-Fuller tests, ADF- Augmented Dickey-Fuller tests, EGC- Engle-Granger Cointegration tests, J (1988) – Johansen (1988), JJ (1990) – Johandsen and Juselius (1990), ECM- Error correction Model . DOLS-Dynamic OLS.

Table 2.4 Summary of Coefficients of Long-run Demand for Money Studies in China

hors	Sample Period/ Frequency	Money	Real income		Elasticity Interest rate	Inflation	others
›w (1987)	1952-1983 (Annual)	Real m_0	1.162		-	-	-
'ton . Ha (1990)	1983-1988 (Quarterly)	Household Money balances	1.66		-	-1.0	-
(1993)	1952-1989 (Annual) 1983-1989 (Quarterly)	Real m_2 Real m_2	1.25 0.719 1.152		-	-	- 0.949 (UP) 0.530 (UP)
›ng al. (1994)	1983-1988 1989-1993 1983-1993 (Quarterly)	Real m_1 Real m_2	1.53 1.81		-	-1.51 -2.21	-
ıang (1994)	1979-1990 (Annual)	Real m_2	2.12		-0.29	-	-
ıfer and ıtan (1994)	1952-1983 (Annual)	Real m_0 Real m_2	1.13 1.33		0.13 0.15	2.48(DEF) 1.52 (DEF)	-
rardin (1996)	1988-1994 (Quarterly)	Real m_0	1.391		-	-0.826	
rize (2000)	1952-1994 (Annual)	Real m_0 Real m_2 Real m_3	1.326 1.510 1.134		-0.169 - -0.319	0.721 0.334 0.306	-
u (2004)	1952-2000 (Annual)	Real m_0 Real m_2	By Johansen	Model		-	-
			1.3165 (RM0)	AN	0.4426		
			1.5354 (RM2)	AB	0.4082		
	1982-2000 (Quarterly)		1.5369 (RM0)	QN	0.1155		
			1.5094 (RM2)	QB	-0.1503		
			By DOLS				
			1.336 (RM0)	AN	0.219		
			1.556 (RM2)	AB	-0.002		
			1.335 (RM0)	QN	0.002		
			1.485 (RM2)	QB	-0.016		

›otes: UP is the urban population ratio account for monetization process. Where two annual models: AN is the model with narrow money, AB is the ıodel with broad money, two quarterly models, QN is the model with narrow money, QB is the model with broad money. See Gu, (2004).

Tables 2.3 and 2.4 above, which reflect the findings of previous studies of money demand in China demonstrate that a long-run stable relationship exists between real balances and its determinants. These studies cover the sample period from 1952 to 2000 and monetary aggregates considered are narrow money m_0 and broad money m_2 though Tseng's work also considered narrow money m_1. The long term interest rates are considered widely by the researchers as opportunity cost of holding money. These studies also present evidences on the effect of the inflation variability on the demand for real money balances in China. In terms of methodologies, some studies construct an error correction model (ECM) to evaluate the dynamic adjustment process of money demand in China in the reform period and a few studies employed Johansen (1988) and Johansen and Juselius (1990) cointegrating techniques to examine the long-run relation between demand for money and its determinants. There is no previous empirical evidence on studies of money demand in China by using Pesaran *et al.* (2001) method. There have been profound changes in money demand and monetary policy in the recent years in China. There are still some unanswered questions which need further research. Therefore, this study intends to make some contributions towards filling in the gaps and improve current literature.

2.5 Summary and Conclusions

In this chapter, major money demand theories, related issues and the more recent developments of the demand for money function have been reviewed. The theoretical developments on money demand began in the classical tradition. Keynes and later economists developed a number of models to provide alternative explanations to confirm the formulation relating real money balances with real income and interest rates. The medium of exchange function of money led to the inventory theoretic formulation. This emphasized the transactions costs under certainty and the precautionary demand for money models introduced the concept of uncertainty. In recent years, many empirical investigations on money demand function for the long-run and short-run in both developed and less developed countries provided more examples of the analysis of the money demand function in China. The role of monetary policy and the financial system has seen significant changes since China's economic reform. The performance of Chinese monetary authorities accelerated the reforms of the banking system and the financial sector. It moved to a system of monetary control through indirect, market based instruments. There are a number of empirical studies about the money demand functions in China. However, after decades, many studies of money, prices and inflation, there still remain un-resolved issues. The further study and estimation of money demand is important for policy purposes.

To develop a better understanding of other influences, a review of the Chinese monetary system will be provided in next chapter which will include a brief survey of the factors influenced monetary control in China. The discussion in the next chapter will concentrate on various aspects of monetary performance and indicate the possible factors affecting money demand in China. The link between money and economic activity in China will be investigated.

Chapter 3 General Outline of the Chinese Monetary System

3.1 Introduction

The objective of this chapter is to offer a general discussion of the Chinese monetary system. From early discussions, it can be seen that the dramatic monetary expansion is a prominent feature of the Chinese economy after many reforms. The performance of real economic sectors, rapid economic growth, structural changes and monetary expansion have been of major interest to economists and provide useful explanations of money demand in China. Many economic factors have now become very important in the determination of money demand. In most societies, the ultimate purpose of economic growth is to raise the consumption and welfare of the people. For decades after economic reform, China evidenced dramatic changes in the savings and money demand of the Chinese household sector. Chinese economic growth led to a tremendous rise in the standard of living of Chinese people and the average wage rate changed significantly. This chapter consists mainly of an analysis and discussion of the monetary system before and after economic reforms and contains an exploration of various factors which influence monetary control in China.

This chapter is organized in four sections. The second section will provide a review of major economic reforms in Chinese monetary system. The third section will analyse various determinants of money demand in China. The additional influences of other variables will be explored so as to provide more consideration regarding the nature of money demand behaviour in the Chinese economy. The fourth section will provide a summary and conclusion.

3.2 Economic Reforms

3.2.1 The Centralized Planning System before Reforms

To understand China's financial sector reforms, it is necessary to take a brief review of the prevailing conditions. Under the old monetary system, Chinese economic development was practically static and was largely locked into a planned economy for about three decades before 1978. With the operation of monetary policy, most prices were fixed. Wages and salaries were essentially frozen (Yi, 1994). The financial sector played little role in the allocation of financial resources under central planning. The People's Bank of China (PBC)[1] was the institution acting both as a central bank and a commercial bank before 1984. PBC was one all-inclusive state-owned bank and the centre for cash, credit and settlement. The PBC was also the monetary authority and responsible for the supply of money (World bank, 1991; PBC Research[2], 2004). The monetary authority paid more attention to control the volume of cash in circulation. Shang (1998) and many papers proposed that an empirical rule existed during the period between the 1960s-1970s. This was so-called 1:8 rule which decided the amount of currency in circulation for a certain period and meant that for 1 yuan cash in circulation, there should be 8 yuans worth of consumer goods available on the markets in a given year. In other words, the velocity of cash was equal to 8 (Shang, 1998). The control on currency implied restraining the aggregate demand to maintain price stability. Interest rate policies played little role in demand management and the adjusting of credit conditions in the economy of China before economic reform (Ding, 2004). There was little economic relationship between money supply

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[1] The PBC was found in 1948. It expanded rapidly after the People's Republic of Chinas was established in October 1949. By 1957 it had branches and sub-branches in the whole country in parallel with the State administrative structure. In accordance with the centralization of credit allocation, all banks were effectively under the supervision of the PBC (Hong, 1993).

[2] PBC Research, 2004- This book was written by PBC Guangzhou monetary policy research group to celebrate the PBC set up 20 years.

and interest rates. The interest rates were administratively set by the monetary authorities and were firmly controlled and used by the central government to achieve its political and economic objectives. The nominal level of interest rates was rarely adjusted and tended to decrease during that period (PBC Research, 2004). Some investments were financed by interest free budget grants.

3.2.2 Various Economic Reforms

In late 1978, China began to reform its economic system and "opened the door" to the rest of the world. There has been a broad discussion on the topics of decentralized economic management and introduction of a market mechanism into China's economy to promote economic efficiency (Shang, 1998). The reforms can be divided into a number of phases. The early phases of the reform were concentrated on transforming the government budget grants into bank credits. There was a significant development of new banks and non-banking institutions (PBC Research, 2004). As a result of the reforms, the price system has been changed. The structural change in the banking sector gives specialized banks more incentive to make profits and the central bank more power to control money supply and the overall credit condition.

1) Banking System Reforms

China began to reform the PBC in 1983 by separating central banking from commercial banking functions. The State Council transferred the commercial banking activities of PBC to the newly created Industrial and Commercial Bank of China (ICBC) (World Bank, 1991). Under the terms of the resolution, the PBC was made into the country's central bank and was to perform only the functions of a central bank (PBC Research, 2004). The following four state-owned banks were constituted as the core of the new commercial banking sector:

- Industrial and Commercial Bank of China (ICBC)

- Agricultural Bank of China (ABC)
- Bank of China (BOC)
- People's Construction Bank of China (PCBC)

The main responsibilities of the central bank (PBC) are to implement macro monetary policies; to control money supply, interest rate and exchange rate; to act as the treasury of the Central Government; to regulate financial markets; to formulate the overall credit and loan plan, and to control the loans and investments of hard currencies (PBC Research, 2004). The ABC remained the principal for agricultural lending functions. The BOC remained its foreign exchange transaction functions. The PCBC established in 1954 continued to manage budgetary funds. Although the new relationship between the Central Bank and Specialized banks was still under the guidance of the central planning system, the old quota management method of credit has been changed into a more flexible credit and loan policy. After the reform, the specialized banks were given more freedom in managing their credit activities and were allowed to transfer funds between different branches in response to variations of the money demand (PBC Research, 2004).

When the reforms began to deepen, the financial sector developed significantly with a more diversified structure and a broader menu of financial instruments. Parallel to the development of commercial banking institutions, various non-bank financial institutions have been established to satisfy the diversified needs for capital investment and corporate finance. These include Trust and Investment companies, Insurance companies, Finance companies, Financial leasing companies, Securities companies and Mutual fund companies. Some of these institutions have an international orientation, such as the China International Trust and Investment company (CITIC). The non-bank financial institutions complement the commercial banks with financial services in the areas of investment banking (Wei, 1999; PBC Research, 2004). In addition to the development of domestic financial institutions mentioned above, foreign financial institutions have been allowed to establish branches, representative offices and joint-ventures with Chinese financial institutions since 1986. Up to 1996, foreign banks had set up 417 representative offices and 123 branches in China (PBC, 1997). Most of these are from the USA, UK, Japan and Western Europe, and are located in Beijing, Shanghai and Shenzhen. The economic reforms from 1978 onwards brought about the structural change of the Chinese monetary system.

Table 3.1 Banking System in China in 2004

Banking system	Branches	Numbers of Staff	Total assets (billion yuan)
Central bank- PBC	2189	140450	
State Commercial Banks (Total)	**78119**	**1396596**	**17288.79**
ICBC	21223	375781	-
ABC	31004	489425	-
BOC	11307	220999	-
PCBC	14585	310391	-
Policy Banks (Total)	**2328**	**64999**	-
National Development Bank of China	37	4678	-
Agricultural Development Bank of China	2275	59487	-
Export-Import Bank of China	16	834	-
Nationwide commercial banks (Total)	**5514**	**143075**	-
Bank of Communications	2403	54408	-
CITIC Industrial Bank	391	11598	-
China Everbright Bank	410	8906	-
China HuaXia Bank	243	7007	-
China MinSheng Bank Corp., ltd	219	6382	-
China Merchants Bank	411	17829	-
Guangdong Development bank	487	11714	-
Shenzhen Development Bank Co., Ltd	255	6999	-
Shanghai Pudong Development bank	329	8817	-
Fujian Industrial Bank	294	8050	-
Hengfeng Bank	72	1365	-
Insurance Companies (Total)	**68**	**262429**	**431.8**
Insurance Group Corporations	5	1898	-
Domestic Funded Insurance Corporations	27	252902	-
Joint-venture Insurance Corporations	36	7629	-
Foreign Financial institutions (Total)	-	-	**513.72**

Source: China Statistical Year Book (2005, pp. 671-681)

Table 3.1 shows that the Chinese banking system made remarkable changes regarding its functions, organization, policy conception and monetary instruments changing from a mono-banking system has been reformed to a diversified financial structure with broader menus of financial instruments in an extremely short period of time. It is realistic to assume that such reforms led to changes in the parameters of the money demand function.

2) Price Reforms

The influence of price level is an important factor for the demand for money function. The relative prices of industrial and agricultural products determine the living standards of urban and rural consumers. The first important price reform started in 1979 by raising the prices of main agricultural products (Yi, 1990). Later, more comprehensive reforms were gradually carried out. The prices of food, some important heavy industrial products, some light industrial products, the textiles industrial and everyday consumer goods prices all have been gradually adjusted. In the commodity markets prices are almost completely free of control in 1990s. Xie (2004) indicated that as a result of the economic reform, the price mechanism has played an important role in economic activities.

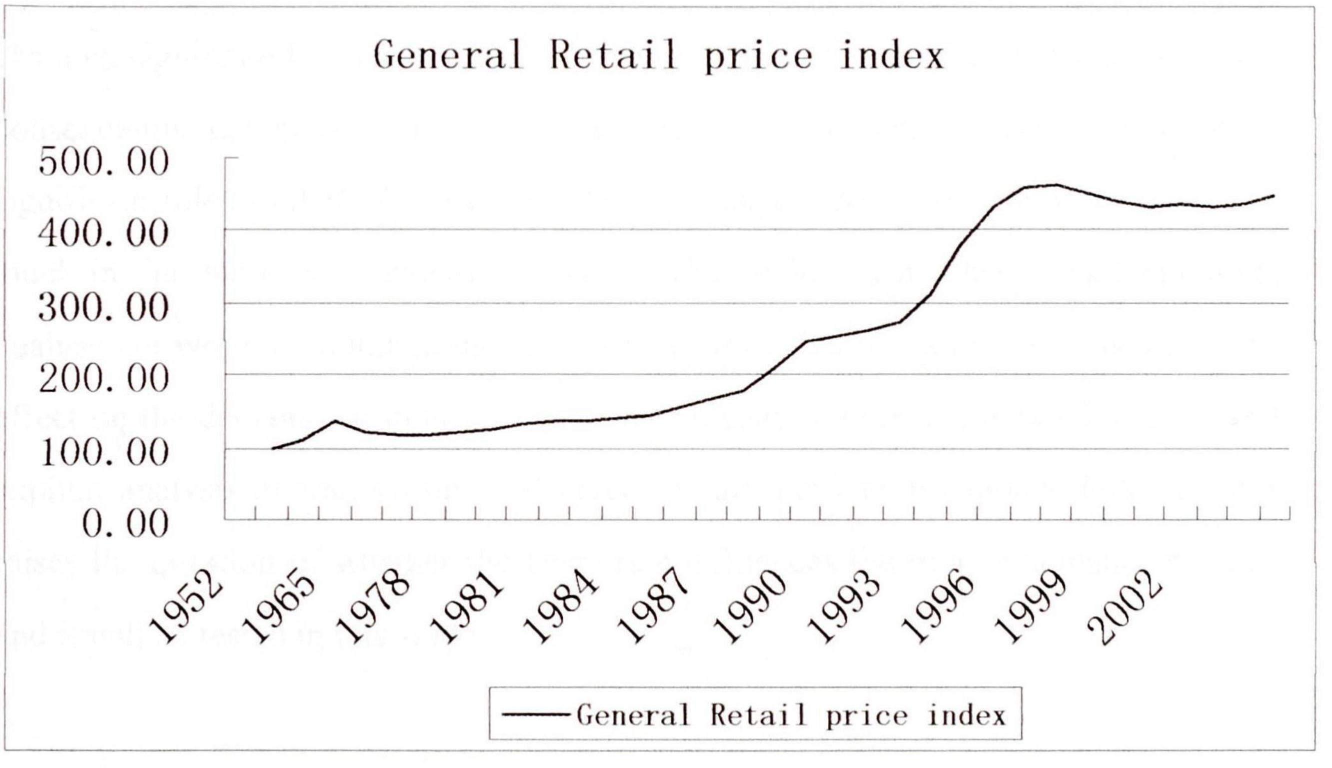

Figure 3.1 General Price Index Chart

Source: China Statistical Yearbook (2005), and early issues. Own graph based on 1952=100

There are many price indices in China. Among them, the general retail price index (GPI) and the free market price index are commonly used. The GPI is also called the official price index. Figure 3.1 shows the fluctuation of general retail price (GPI) during period 1952-2004. The advantage of the official price index is that it is calculated on a broad basis (See examples of Chow, 1985; Yi, 1993; Gu, 2004). Before the economic reforms, about 97% commodity price were determined by the central planning system in which the industrial sector was dominated by the state-owned enterprises and the agriculture sector was organized by communes. By end of 1996, the estimates reveal that more than 70% retail sales and 70% of the output and input prices of the SOEs were already free of control and commodity markets prices are almost completely free of control (Wei, 1999). It is suggested that the Chinese government will eventually free all price controls at the end of this decade.

Yi (1990) discussed that the price reform also included 'wage reform'. After reform, incomes of staff members and workers were related to their job performance and entailed the application of the 'responsibility system' to the enterprise concerned. Figure 3.1 illustrates the total wages bills from 1952-2004. The total wage bill has changed significantly after economic reform. This growth increased money costs and consequently the price level. The rapid growth of nominal wages also played a significant role in inflation. However, the percentage increase of real wages was very much in line with the productivity increase (Yi, 1990). A number of past empirical analyses in western countries in the past confirmed that the wage rate has a positive effect on the demand for money. The evidence suggested that it is unwise to neglect explicit analysis of transactions and precautionary motives for money holding. This raises the question of whether the wage rate influences the money demand in China and it will be tested in this study.

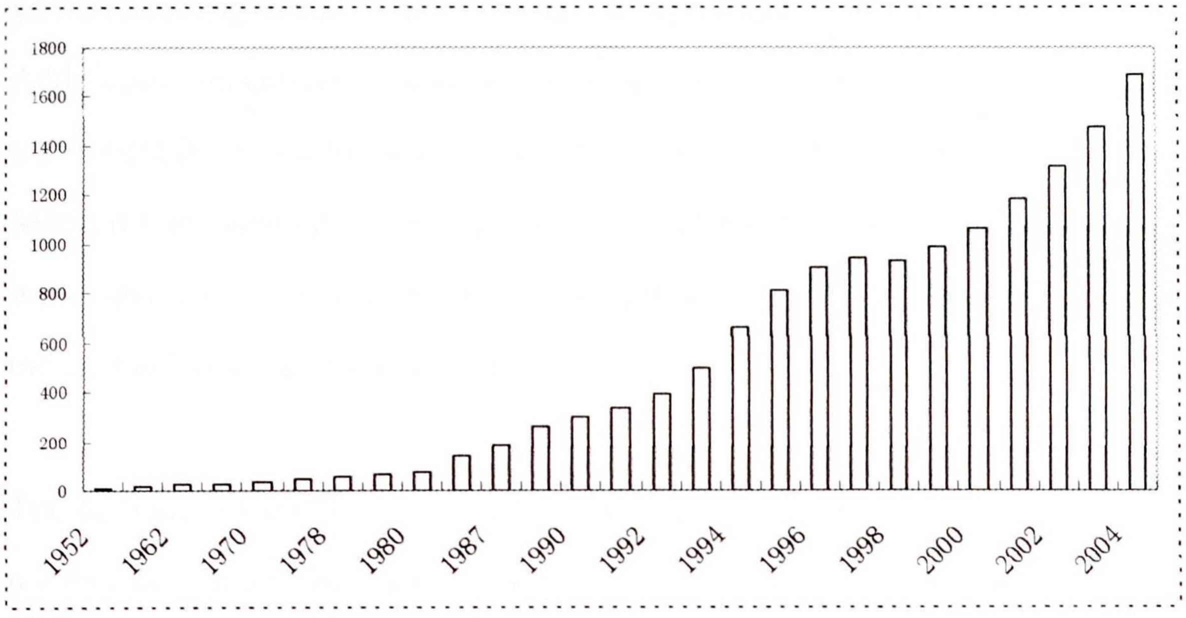

Figure 3.2 Total Wages Bill in China 1952-2004 (in billions of Yuan)

Source: China Statistical Year Book (2005) and early issues, Own graph based on 1952=100.

3) Exchange Rate Reforms

Another element of price reform was the linking of domestic and foreign prices through the exchange rate. This meant that for foreign trade, marginal imports and exports are purchased and sold at free domestic prices, reflecting both domestic market condition and the value of the exchange rate (Yi, 1990). Direct foreign investment flows into China during the 1990s have been higher than to any other developing country. The exchange rate reform has been one of the most dramatic changes in China since the implementation of "open trade" policy (PBC Research, 2004). In the pre-reform period, the exchange rate of the Chinese currency (RMB) did not serve to relate the internal and external price systems but instead was used as an accounting tool. To reduce the domestic currency losses of foreign trade and to provide incentives for exporters, the Chinese government devalued its currency by introducing an internal settlement rate in trade transactions. Between 1985 till 2004, the official exchange rate was devalued significantly by over 60% from a year-end rate of RMB 3.2 yuan per U.S. dollar in 1985 to RMB 8.2767 yuan in 2004 (China Statistical Year Book, 2005). To maintain its exchange rate policy, the central government tightened controls over foreign exchange transactions in mid 1998. Additional incentives, such as further tax exemptions and simplification of administrative procedures, were introduced to attract more Foreign Direct Investment. Measures to stimulate export growth, crucial for the stability of the exchange rate were introduced, such as increasing tax rebates for selected export commodities and increasing bank credit for the export sector.

The demand for money is likely to depend on the exchange rate. There have been a number on studies which have considered exchange rate fluctuations of the money demand functions of different countries. However, as the Chinese RMB has not been freely convertible with other important currencies in the world such as US$, Deutsche Mark for years until 1997. Therefore, this study will ignore the influence of exchange rate fluctuations on money demand functions in China and will leave it for future researches.

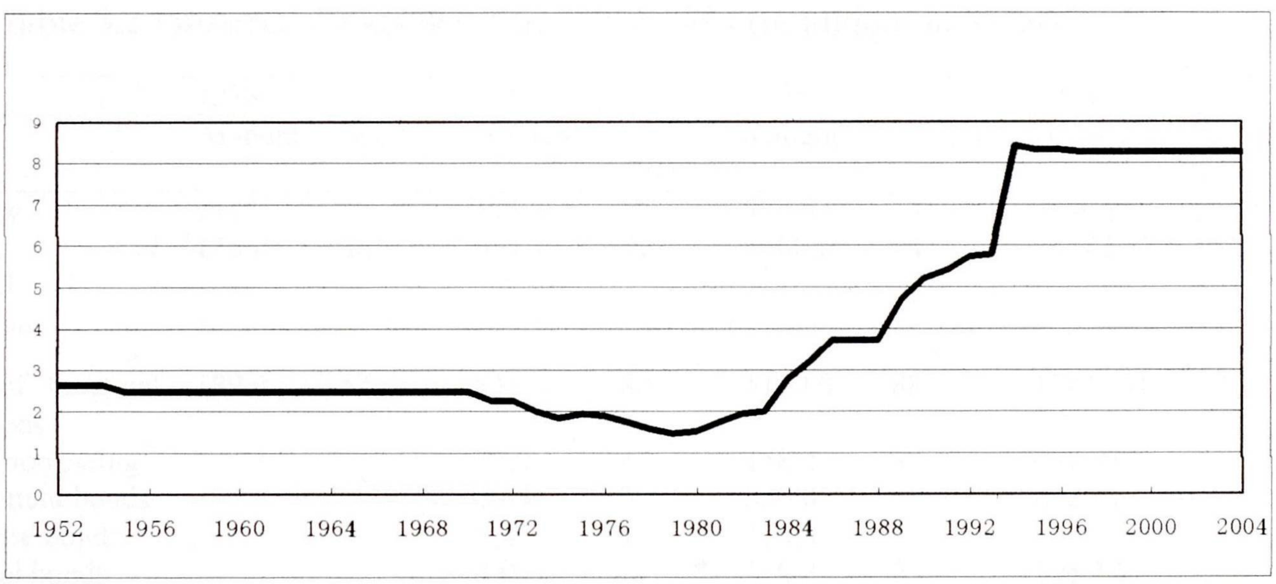

Figure 3.3 Exchange Rates in China 1952-2004

Source: Data of 1953-1987 come from people's bank of China research and statistics dept., (1988, pp. 156-157), Data of 1989-2004 come from various issues of international financial statistics of IMF and web www.cei.gov.cn.

4) Changes of Financial Structure

In China, financial assets are composed of currency in circulation, deposits taken by financial institutions, loans provided by financial institutions and securities issued by different sources. The evidences from Yi (1996) and Wei (1999) show that there has been remarkable changes and development of financial structure in China. This is because of the development of financial institutions; financial instruments and financial markets which provided various savings and financial possibilities for economic factors (Xie, 2004). This implies that financial reforms have had positive effects on the economy. Before reform, there was virtually no other form of financial assets except currency in circulation and bank deposits. In recent years, many alternative savings instruments became available financial markets, such as shares and bonds or deposits by the banks whilst people are holding money in the expectation of a higher return in future. This is an indication of the degree of financial development in the economy. There are both real economic and financial factors that shape the level and structure of savings.

Table 3.2 Financial Assets Structure 1978-2004 (in billions of Yuan).

	1978		1986		1995		2004	
	Amount	% GNP	Amount	% GNP	amount	% GNP	amount	% GNP
Currency	21.2	6	121.8	12	788.5	14	2146.85	15.72
Deposit of financial institutions	130.0	36	581.4	57	5400.0	94	24142.43	177
Loans of financial institutions	189.0	52	811.6	80	5100.0	88	17819.78	1.30
Budget borrowing			37.0	4	158.2	3	687.93	-
Government bonds			29.3	3	350.0	6	692.39	-
Enterprise bonds			8.4	1	170.0	3	-	-
Financial bonds			3.0		110.0	2	395.47	-
Shares					450.0	8	-	-

Source: Data of 1978-1995 come from Yi (1996, p.27), data of 2004 come from China Statistical Yearbook (2005, pp289-679).

Notes: Total deposits of financial institutions of 2004 include banks, savings deposits agencies of postal offices, housing saving banks, urban credit cooperative banks, rural credit cooperative, urban credit banks, foreign-funded banks, financial trust investment agencies and financial companies etc.

5) Monetary Policy Reform

In China, the role of monetary policy and the structure of the financial system have undergone significant changes since the market oriented reforms were introduced. In the early stages, reforms highlighted the inexperience of the monetary authority in the new economic environment being characterized by pumping too much money into the economy resulting in the economy overheated. The official inflation rate reached around 20% in 1988 and in 1995 (PBC research, 2004). Figure 3.4 shows inflation fluctuation during 1952-2004. This gave to a tighter monetary policy by PBC and has played an important part in stabilizing the economy (World Bank, 1996). However, the Chinese economy has been plagued by low efficiency of state owned large and medium size enterprises in 1990s which had accumulated a chain of big debts. In order to improve the effectiveness of monetary policy in a changing economic environment, the Government transformed direct control of bank credit into indirect management of money aggregates. This policy change relied on the information of money aggregates being able to predict future movements of economic activities. Through the reform, the PBC can use not only direct, but also indirect monetary instruments to conduct monetary policy (PBC Research, 2004). Direct monetary instruments are mainly discount and rediscount policies, open market operations, and legal reserves requirements[3]. The monetary policy has played a central role in China's macroeconomic control of economic overheating in the past two decades. To conduct the new concept of monetary policy, new monetary instruments are necessary. Hence, China's macroeconomic stability during the transition will depend basically on successful monetary management over the foreseeable future.

[3] 'Central Bank Law' was put into effect in May 1995 and represented a historic step towards developing the PBC into a modern and competent central bank.

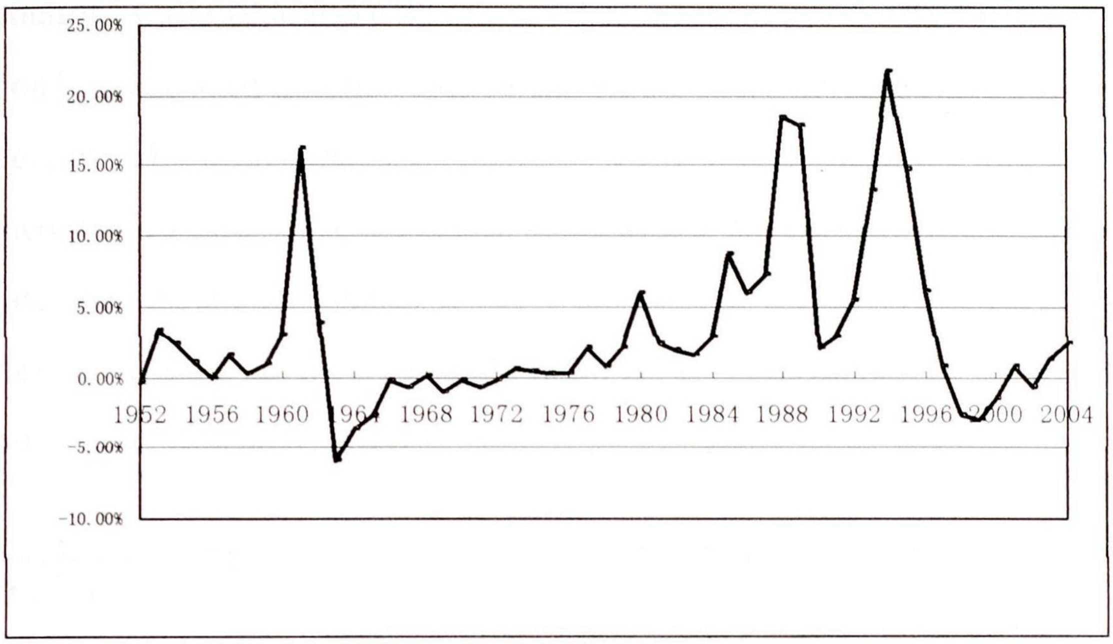

Figure 3.4 Inflation Rate in China 1952-2004 (OPI)

Source: China Statistical Year Book (2005) and early issues. OPI is official price index. Own graph based on 1951=100

6) Interest Rate Reforms

The influence of interest rates on the demand for money is very important for both economic theory and policy. As discussed earlier, interest rate policies played little role in demand management and adjustment of credit conditions in the economy in China before economic reform, as there was little economic relationship between money supply and interest rates (Yi, 1993). Since reform, there have been various interest rates appertaining to the newly introduced savings and financial instruments in China. These rates include central bank interest rates, commercial bank interest rates, inter bank interest rates, and securities interest rates (Ding, 2004). The central bank interest rates are not determined in the financial markets, but set by the central bank according to policy needs. The commercial bank interest rates are composed of bank deposit rates paid on deposits and bank lending rates on loans to borrowers (World bank, 1996). The commercial banks rates and central bank rates remain administratively determined by the monetary authorities. The inter bank rates are the costs of inter bank borrowing between the commercial banks and are relatively free of control by the central bank. The bond interest rates are paid by the issuers of the bonds who can be governments, enterprises, or financial institutions with interest rates determined on the securities markets. Bond-interest rates are specified on fixed-income securities which are placed in the capital market. The determination of interest rates on Government bonds is based on demand and supply in the markets. These rates are usually set higher than those for savings deposits of the same maturity (Wei, 1999; PBC Research, 2004).

Table 3.3 Comparison of Deposit and Loan Rate (%) during 1994-2004

Description	March 1994	Aug. 1996	July. 1998	Jun. 1999	Feb. 2002	Oct. 2004
Indexed deposit rate						
3 year	12.24	8.28	4.95	2.43	2.52	3.24
5 year	13.86	9.00	5.22	2.70	2.79	3.60
8 year						
Loan rate						
3 year	12.24	10.98	7.11	5.94	5.49	5.76
5 year	13.86	11.70	7.65	6.03	5.58	6.12

Source: Data come from China Statistical Yearbook of China (2005, p676) and early issues.

Notes: Since Nov.1999, the lending rate for medium and small size enterprises could be 30% higher than nominal interest rates, for large size enterprise, the lending rate could be as much as 10% higher than nominal interest rates. For all financial institutions, the lending rate could be 10% lower than nominal interest rates.

After many reforms, the price mechanism has started to play an important role in economic activities. However, bank interest rates on deposits and loans and the most relevant prices for savings and investment are still under administrative control. In reality, there are still shortcomings and problems needing further reform of the administratively determined interest rates (Ding, 2004). Typically it has been found that administered interest rates are one of the main obstacles to economic reform in China and are inconsistent with the integration of the Chinese economy into the world economy. Without market equilibrium interest rates, it is impossible for the financial market to function properly. Economic integration into the world economy requires financial opening and a more profound development of financial markets to facilitate international settlements, import and export financing, and fund raising in both domestic and international financial markets (PBC Research, 2004). To increase the competitiveness of the domestic banking sector, it will be necessary to eliminate interest and credit control in this sector. The control over interest rates should be gradually relinquished so that interest rates could be used in the money demand equation to reflect the true opportunity cost of holding money in the future (Ding, 2004).

7) Fiscal System Reforms

The role of government planning agencies was to be fundamentally reduced in 1990s. Only major economic activities, or products, such as transport and energy were to come under a form of 'Guidance Planning' or under the operation of market forces (Wei, 1999). Financial reforms gave State Owned Enterprises (SOEs) more freedom in decision-making and permission to retain some of their profits. Each enterprise should be able to act as a legal agent and as a relatively independent economic entity. After reform, private sector business appeared to be more efficient in production. However, the SOEs are still subsided by the government through low interest bank loans while the private sector faces hard budget constraints. In the early 1990s, investment projects were undertaken everywhere in China and the Chinese economy appeared to overheat considerably. To cool off the economy, the government made a serious attempt to reduce the growth rate of the money supply by tightening bank credit and in addition raising interest rates on government bonds and bank deposits (Shang, 1998; PBC Research, 2004). To lower inflationary expectations, certain measures of price control were imposed and the government increased the quantity of bonds issued to the public to soak up liquidity.

8) Other Important Reforms

According to the State Council Official Statement, the following financial sector reforms were implemented after 1997.

i) The PBC relies more and more on indirect monetary instruments such as interest rates, refinancing mechanisms and open market operations to achieve the monetary target.

ii) PBC attempts to make the State Owned Banks (SOBs) into independent commercial banks and to establish a banking sector characterized by the separation of policy financing from commercial banking. This has had increasing success. One result was the establishment of three policy-oriented development banks to take over policy loans business from the SOBs.

iii) The PBC be a unified competitive and strictly regulated financial institution. A short-term treasury bond market in addition to inter bank lending and borrowing are introduced in the money market. This is an important step to provide short-term instruments for government finance on the one hand. On the other hand, it is a preparation for the implementation of open market operation. Financial institutions are allowed to buy and sell these treasury bonds so as to adjust their liquid reserves.

iv) PBC to make the RMB freely convertible with other important currencies in the world such as US$, Deutsche Mark, Japanese Yen from 1997 (State Council of People's Republic of China: official Statement, 1998).

3.3. Analysis of the Determinants of Money Demand in China

The relationship between the demand for money balances and its determinants is a fundamental part of most theories of macroeconomic policy. Earlier evidence suggested that a few variables, essentially income and interest rates with appropriate allowance for lags were capable of providing a plausible and stable explanation of money demand. Referring to the Chinese monetary system, there are some other factors which influence the control of money in recent years, such as the monetization process, saving effects and wages. During the 1980s, the Chinese economy began to experience a shift from a system of direct macroeconomic control to a more indirect one. A rapid growth of currency stocks in circulation took place. The Central Bank had more ability to forecast the quantity of money which consumers demanded while maintaining a certain level of national income and rate of inflation. The policy makers paid more attention to monetary control.

1) Monetization Process in China

The term monetization refers to the process in which the proportion of economic activities conducted by money increases. Consequently, money supply should increase not only in proportion to the growth of the economy, but also to accommodate the newly monetized sectors (Yi, 1994). In a developing country, the economy can be divided into two parts: monetized and non-monetized (Ghatak, 1995). When considering the demand for money in China, besides regular transaction and precautionary demand, there is an extra demand for money caused by the monetization process. Started from the second half of the 1980s, there were unusually large amounts of cash circulating in the hands of public with many transactions that should have been done through bank transfers actually being conducted in cash. Some SOEs and other firms started to raise funds by issuing bonds and stocks directly to the public and not through the banking system. These transactions were usually outside the Central Plan and had autonomous management powers (Yi, 1994).

There are two important macro indicators related to the monetization process. a).The ratio of money to GDP, Figure 3.5 shows that this ratio has been increasing sharply during the reform period. b). The total stock of financial assets has increased rapidly. Table 3.2 has shown that the composition of the financial assets and the structure of national saving have changed substantially during reforms. Xie (2004) indicated that more forms of financial asset appeared in the Chinese economy and the control powers of the financial assets have been decentralized. The proportion of financial assets owned and controlled by the central government has declined steadily and the proportions of financial assets owned by households, enterprises, financial institutions and local governments have increased. The monetization process accompanied by rapid income increases of both individuals and enterprises has boosted money demand. Since economic reform started, the growth rate of money supply accommodated both the GDP growth and the monetization process, each important reform step being associated with a monetization consequence (Yi, 1994).

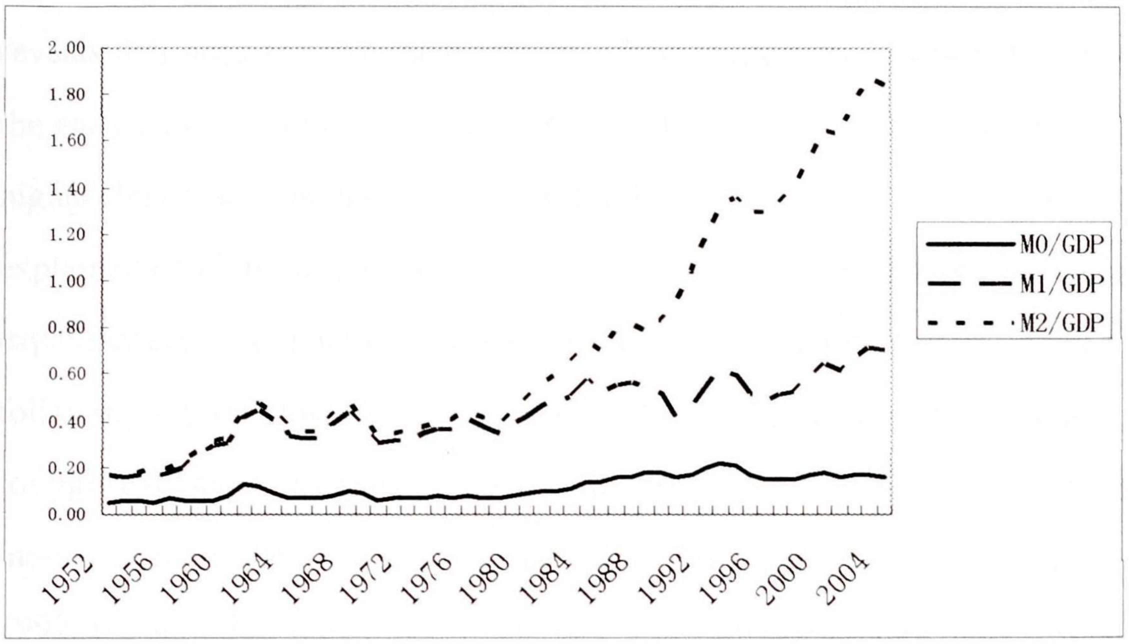

Figure 3.5 The Ratio of Money Supply to GDP

Source: China Statistical Year Book (2005) and early issues

Ding, (2004) reveals that the ratio of money supply and GDP had risen rapidly during 1980s-1990s. One plausible hypothesis is that the velocity of the economy has risen very fast as a result of reform and growth and has led to a very fast rate of financial deepening

As is commonly agreed in China, the overheating of the Chinese economy was also due to monetization of the Government's deficit, which is caused by the combination of the decline in government fiscal revenue and the lack of a mechanism that imposes effective financial control over the state sector (Ma, 1993).

2) Monetary Aggregates

Despite some fluctuations, China's monetary policy in recent years can generally be characterized as expansionary. Figure 3.6 illustrates the growth of m_0, m_1, m_2 and reveals that prior to 1988 the evolution of the aggregates was broadly similar. During the early stages of reform, the growth rate of currency in circulation was significantly higher than that of m_1 and m_2 (World Bank, 1996; Xie, 2004). This behaviour can be explained of high inflationary expectations. Monetary and credit polices were largely expansionary throughout the early 1990s accommodating the investment boom and following a brief slowdown, domestic credit started growing again. The sharp rise in foreign exchange reserves in 1994 and 1995 fuelled strong expansion in reserved money through 1995 (Xie, 2004) and this influenced the growth of broad money. In 1997, the inflation rate was brought down by cutting interest rates several times and lowering the bank reserve twice while GDP growth remained at a high level. After 1997, the banks slowed down in loans to the SOEs but increased in loans to non-state enterprises which are the primary engines of growth in China's economy (PBC Research, 2004). The Government also created new safe lending opportunities for the banks by announcing housing reforms which included privatisation of the housing stock (PBC, 2000). The banks then expand mortgage lending on the basis that the household debt will be fully backed by a marketable asset and hence boost aggregate demand. Figure 3.7 shows real estate investment status during 1991-2004.

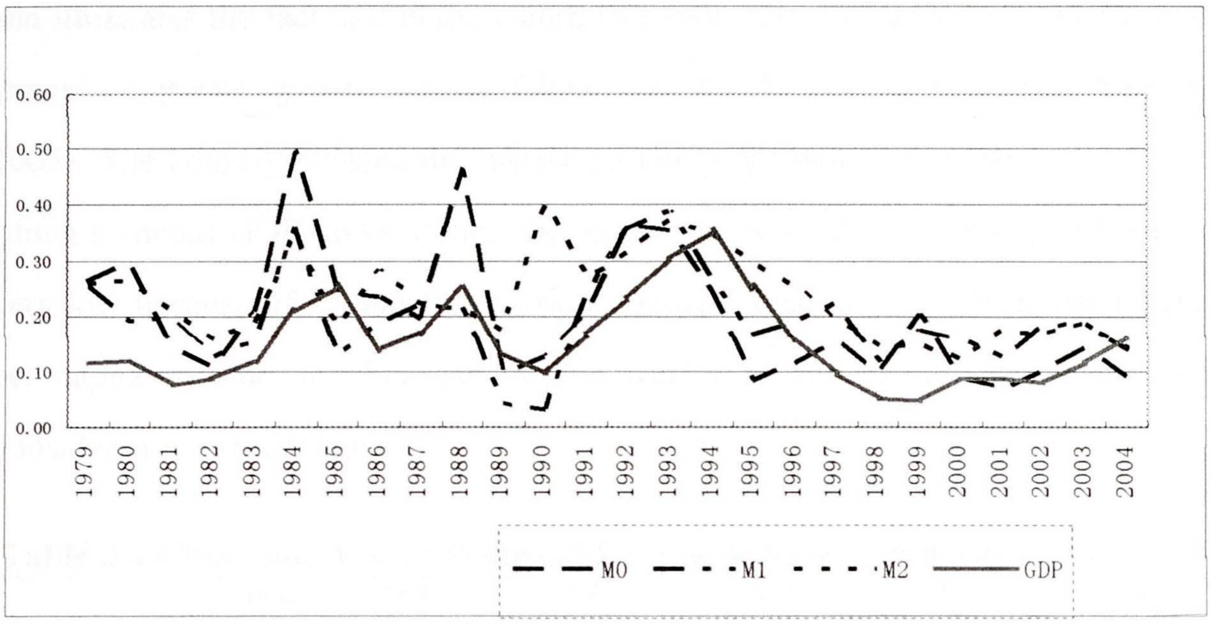

Figure 3.6 Growth Rates of Money and GDP 1979-2004

Source: China Statistical Year Book (2005) and early issues.

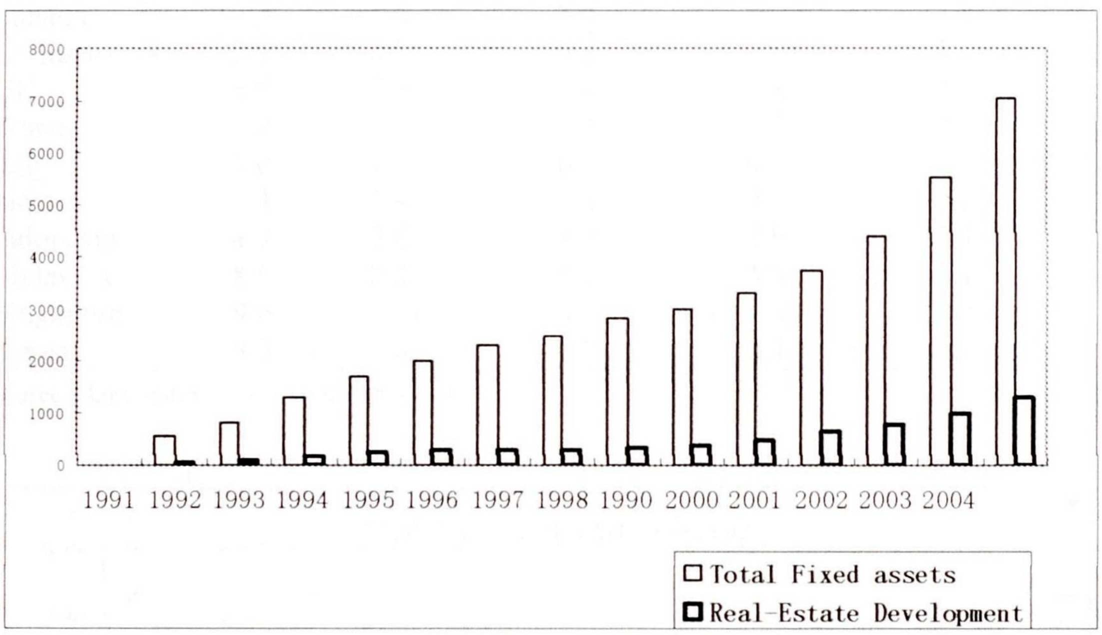

Figure 3.7 Real Estate Investment in China 1991-2004 (in billions of Yuan)

Source: Data of 1991-2003 come from PBC research (2004, p.191), Data of 2004 come from China Statistical Yearbook (2005)

3) National Income

In the macro environment of the world economy, China has made great efforts to absorb foreign capital in order to speed up economic development. In the early 1990s, there was strong economic growth in China and the region has become one of the engines of global economic recovery. Table 3.4 shows worldwide GDP growth rates and illustrates the fact that in the eighth five year plan during 2000-2004, the average annual economic growth rate in China was 8.56% (China Statistical Year Book, 2005). The country boasted the fastest economic growth rate in the world. Although China's annual GDP ranks among the largest in the world, its per capita GDP is still very low because of its huge population. Figure 3.8 shows that China has a very low per capita income and because of this weakness, per capita income will not be considered in present study.

Table 3.4 China and World Wide GDP Growth Rate Comparison (%)

	2000	2001	2002	2003	2004	5year average
World average	4.6	2.5	3.0	4.0	5.1	3.84
China	8.0	7.5	8.3	9.5	9.5	8.56
USA	3.7	0.8	1.9	3.0	4.4	2.76
Japan	2.8	0.2	-0.3	1.4	2.6	1.34
Canada	5.2	1.8	3.4	2.0	2.8	3.04
Germany	2.9	08	0.1	-0.1	1.7	2.52
UK	3.9	2.3	1.8	2.2	3.1	2.66
France	4.2	2.1	1.1	0.5	2.3	2.04
Italy	3.0	1.8	0.4	0.3	1.2	1.34
India	5.4	4.8	4.4	7.5	7.3	5.88
Indonesia	4.9	3.8	4.4	4.9	5.1	4.62
Malaysia	8.6	0.3	4.1	5.3	7.1	5.08
Singapore	9.6	-2.0	3.2	1.4	8.4	4.12
Korea	8.5	3.8	7.0	3.1	4.6	5.4

Source: China Statistical Yearbook (2005, p.907).

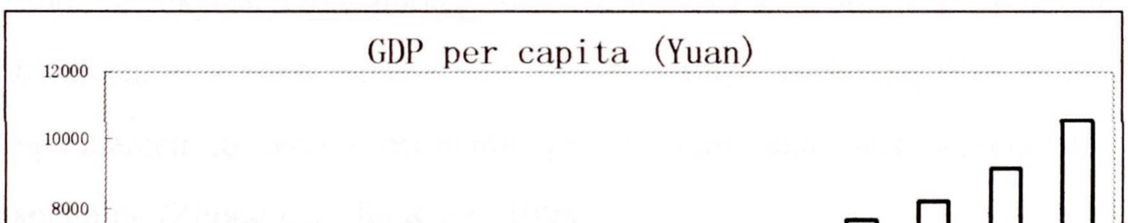

Figure 3.8 Per Capita GDP in China 1952-2004

Source: China Statistical Year Book (2005) and early issues.

4) Savings Effects

The increased ratio of money supply to GDP is indicated by the rapid growth in household savings balances and shows that there has been a remarkable development and implies that financial reforms have had positive effects. The last decade evidenced dramatic changes in the savings and money demand of the Chinese household sector (Shang, 1998; PBC Research, 2004). Prior to 1979, the Chinese system did not view private savings as being a source of investment funds. Lending for investment came from the budget and was interest free. Banks did offer low interest rates on deposits and used these deposits to make short term loans to enterprises. Households, in turn, received wage payments in currency. The Chinese authorities have experienced several major failures in controlling monetary expansion, with immediate implications for savings behaviour. Since 1979, considerable autonomy has been granted to enterprises in wage determination as well as permitting them to retain profits which they were previously required to remit to the government. The price system has not been liberalized as rapidly as wage, so the result has been the rapid rise in savings. In addition, banks have been given greater autonomy with respect to interest rates among other things. In the 1990s, PBC was concerned that liberalization of bank interest rates would result in a 'Saving War' as performs were implemented to reduce economic growth rates and thus prevent such an event happening (Zhong Guo Jin Rong, 1998).

There have been remarkable changes in China's savings level and savings structure. Figure 3.8 shows that especially for the period of 1985-2000 when average GDP growth in China was the result of the capital accumulations, it was supported by an extraordinarily high savings rate from household sector because positive deposits rates induced people to save instead of consume (PBC Research, 2004). Now savings have become increasingly voluntary and in recent years markets for most commodities such as clothes, shoes, etc, have turned a seller's market to a buyer's market. On the financial markets, there are many alternative savings instruments available, such as shares and bonds or deposits by the banks. Savings for self-finance investment were increased. The introduction of private ownership has induced some households to establish their own commercial enterprises.

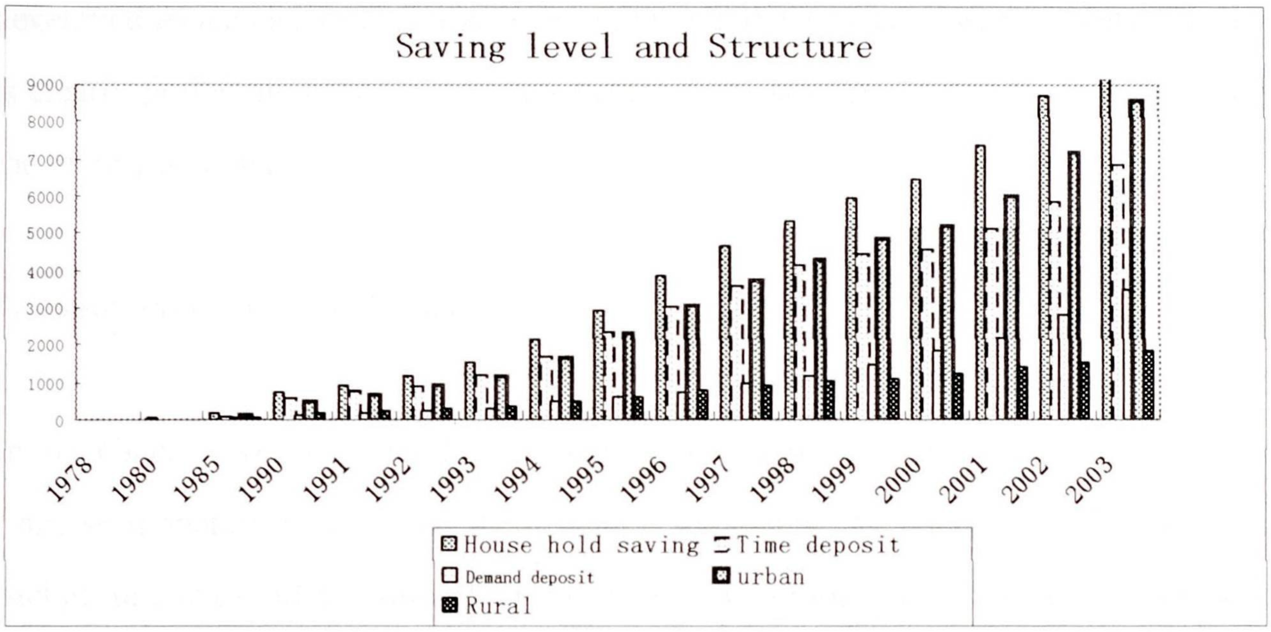

Figure 3.9 Savings Level and Structure

Source: China Statistical Year Book (2005) and early issues.

5) Inflation

The significance of the expected rate of inflation as an important factor influencing the demand for money has been well established. It is often claimed that developing countries are particularly prone to inflation and that they experience noticeably higher rates than do developed countries (Ghatak, 1995). Inflation in China was suppressed in the pre-reform period of fixed prices. Price reform was one of the factors which caused high inflation and these high expectation in the late 1980s caused instabilities in the economy. The upward trend of prices was sustained in 1994 but government policies helped lower inflation in 1995 and edged GDP growth down to a more sustainable level (World Bank, 1996). Having slowed the rate of growth of domestic demand and reduced the inflation rate, the authorities have been concerned that growth has slowed down too fast at a time when the international economic environment was becoming more difficult. Interest rates were cut three times in 1996-1997 and after 1997, the inflation rate was brought down to below 3 percent through the implementation of a soft landing programme (PBC Research, 2004). For estimating money demand function in countries where the financial sector is not well developed especially in China as a developing country, a consistent monetary policy is clearly preferable because inflation expectations are very important in determining the money demand.

3.4 Summary and Conclusions

In this chapter, we have attempted to give an overview of development patterns of the Chinese monetary system and its structural dynamics. An analysis of the historical background is useful and important for understanding the demand for money function in China. The description of the Chinese economy shows a long history of political and economic fluctuations. Under the central planning system, an excess supply of money would have little direct impact on domestic prices and the balance of payments. The operation of monetary policy in this system could be described as the set of rules and practices, which were adopted to implement the credit and cash plans. The task of supplying funds to the enterprise was divided between the government budget and banking sector. Credit policy was provided with the minimum of liquidity necessary to satisfy the controls of the price, production and distribution systems. After 1979, China attempted various reforms of the economic system which involved monetary banking system reform and the use of monetary policy at different levels. The monetary authorities had much greater responsibility to keep macroeconomic balance. The newly established central bank was gradually developing new policy instruments to control credit activities and ensuring that their activities are consist with overall financial stability. The reforms of China's economic system have included some new tools of macroeconomic management. As a part of this process, the influence of monetary policy on the level and composition of aggregate expenditures is increasing, and the nature of both policy instruments and the targets facing the monetary authorities are gradually changing. From the above analysis, it can be seen that there are some special features of China's money demand system post reform. The monetization process accompanied by rapid income increase of both individuals and enterprises has boosted money demand. Household savings have been quite sensitive to changes in price levels and interest rates. Wages as part of income changed significantly during the reform. All these variables are important and could be considered as possible additional causes of the influences on the money demand. Therefore, an extension to existing empirical studies on the money demand function in China will be provided in later chapters.

Chapter 4 Tests of Money Demand Functions in China, 1952-2004: Data, Methodology and Test Results

4.1 Introduction

In this chapter, time-series modeling techniques will be applied to derive reliable estimates of demand for money function in China. The time series data uses three definitions of money, currency in circulation m_0, narrow money m_1, and broad money m_2. Narrow money comprises currency and demand deposits held by households, enterprises, and institutions, while broad money consists of narrow money plus time deposits and savings deposits. As a planned economy, China was under control of a centralized planning system before the 1978 economic reform and currency in circulation played an important role in relation to the determinants of money demand for a long while. Therefore, this study would like to draw attention to all these measurements of money. Tests for stationarity and cointegration of various time–series and estimation of error-correction models are the standard diet of modern time-series modeling. The research into the demand for money function will proceed at two levels, one concerned with an examination of long-run trends, the other dealing with short-run dynamics. The main objective of this section is to determine if there is a long-run stable relationship between money demand and its determinants on the basis of annual data for the period 1952-2004.

The literature survey suggests that the money demand functions may be estimated with different scale variables. In this study, m_0 stands for currency in circulation, m_1 is narrow money comprises including currency and demand deposits held by households, enterprises and institutions. m_2 is broad money which consists of narrow money plus time deposits and savings deposits. y is gross national income. m_0 , m_1 , m_2 and y are all in billions of yuan. These variables are deflated by the general price index. One year savings deposits rate r is selected as a proxy variable for long-term interest rate. For the modified money demand functions in Chapter 5, total wage index with base year of 1952=100, nominal total savings in billions of yuan and population in millions are being utilized. In this study, annual data (1952-2004) is collected from Statistical Year Book of China (SYBC). The selection of the estimation period is based on the availability of relevant data. The full set of nominal data, descriptions, and sources are presented in Appendix 2 and 3, respectively.

The rest of this chapter is organized as follows: the second section will outline the methodology and econometric considerations for each of the techniques to be utilized. The third to ninth sections will demonstrate the empirical results for each technique used. The testing results will be reported in full in the appendices along with the original data set. The last section will make comparison of the various estimations of the money demand functions in China under the economic reforms to investigate the further relationship between money demand and economic activities in China during recent years. The last section will also provide a conclusion and summary.

4.2 Methodology and Equations

This chapter will estimate and compare the results from testing m_0, m_1 and m_2 separately in different equations.

The classical demand function for money is estimated in their natural logarithms of the form:

$$(m/p)_t = a + by_t + cr_t + u_t \qquad (4.1)$$

Where (m / p) is the real money supply, y is the real income, r is the long-term interest rate, p is the price index.

The money demand function is also estimated in their logarithms of the form:

$$m_t = a + by_t + cr_t + dp_t + u_t \tag{4.2}$$

Where m is the nominal money supply, y is a real income, r is the long-term interest rate, price index p is taken as a proxy for inflation rate.

The dummy variable D will be added in above equations to highlight the influences of the economic reform. The estimated period will be separated into two: $D = 0$ for the period 1952-1978, $D = 1$ for the period 1979-2004[4].

Econometric models are implemented by Microfit version 4.0. For investigating the long-run equilibrium among time-series variables, the following econometric methods are employed.

a). Tests for Stationarity

The cointegration test requires that the economic time series are integrated of order one. In other words, the data should be stationary in their first differences but not in levels. Therefore, before undertaking estimation of regression equations involving time-series variables, one has to check if all the variables in the same regression equation are stationary. To determine the order of integration, three procedures will be considered in turn. They are the Autocorrelation Function Approach, the Augmented

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4 As analyzed in previous chapter the Chinese monetary system and financial structure have undergone profound changes since 1978 after culture revolution. With the dramatic economic development and institutional changes as a result of the economic reforms, it is likely that the demand for money in China also changed significantly. The previous work by Yi (1993) firstly added one intercept dummy to separate the estimated period into two- prior to and after economic reform. Qin (1994) supported these findings and showed that the increase of money supply in excess of the economic growth was the main cause. Present study re-exams the stability of money demand function before and after economic reform in order to present further evidence on the relationship between money demand and economic activities in China. This study will extend Yi's work by using additional variables with longer period and applying time-series methodology and make the tests of the variables involved in the demand for money regressions for cointegration.

Dickey-Fuller test (Dickey and Fuller, 1981) and the Phillip-Perron test (Phillip and Perron, 1988)

b). Cointegration Tests

The stabilization policy should aim at those components of money which are cointegrated with all the explanatory variables. To achieve this objective, both single and multivariate cointegration procedures by Engle-Granger two-stage cointegration method(EGTS), Phillips-Hansen cointegration approach, Pesaran *et al.* (2001) cointegration procedure along with CUSUM and CUSUMSQ stability tests and Johansen Multivariate Cointegration techniques are employed. Granger Causality Test is applied to indicate if either uni-directional or bi-directional causality exists in the variables. Wald test for homogeneity is applied as well. The Chow parameter constancy tests is used to determine whether the parameters being estimated are stable or not over the estimation period. By using various methods, the aim is to find a more appropriate money demand function in China.

c). Error Correction Model (ECM)

The ECM has proved to be one of the most successful tools in the field of applied money demand research. This type of formulation of ECM is a dynamic error-correction representation in which the long-run equilibrium relationship between money and its determinants is embedded in an equation that captures the short-run variation and dynamics. Once long-run relationship is established, the ECM estimates will be obtained.

4.3 Tests for Stationarity

To determine the order of integration, following three procedures will be considered in turn.

1) Autocorrelation Function Approach

The test is based on the autocorrelation function and is defined as the covariance at lag divided by the variance. From a theoretical point of view a time series is a collection of random variables. Such a collection of random variables ordered in time is called a stochastic process. Time series econometrics assumes that the stochastic process under examination is stationary. One way of describing a stochastic process is to specify the joint distribution of the variables Y_t.

The mean $u_t = E(Y)_t$ (4.3)

The variance $\sigma^2{}_t = \text{var}(Y_t)$ (4.4)

The autocovariances $(t_1, t_2 \ldots t_n) = \text{cov}(Y_{t1} + Y_{t2})$ (4.5)

Where n is the sample size.

When $t_1 = t_2 \ldots = t_n = t$, the autocovariance is $\sigma^2{}_t$.

$\gamma(k)_t$ is the autocovariance coefficients at lag k.

$$\gamma(k)_t = \text{cov}(Y_t, Y_{t+K}) \qquad (K \neq 0) \qquad (4.6)$$

Since $\text{var}(Y_t) = \text{var}(Y_{t+k}) = \sigma^2 = \gamma(0)$ (4.7)

Then the autocorrelation coefficients are

$$\rho_k = \gamma_k / \gamma_0 \qquad (4.8)$$

The null hypothesis is that the series is stationary, and the alternative hypothesis is the series is not stationary. If ρ_k falls into the calculated confidence interval, then the null hypothesis is accepted, otherwise it is rejected. Table 4.1 shows the estimation result.

2) Augmented Dickey-Fuller Unit Root Test

To test the stationarity of a data, such as Y, a general form of ADF regression can be written as:

$$\Delta Y_t = \beta_1 + \beta_2 T + \beta_3 Y_{t-1} + \sum_{i=1}^{k} \alpha_i \Delta Y_{t-i} + u_t \tag{4.9}$$

Where ΔY_t is the first differenced series of Y, T stands for the time trend, k is the number of the lags used and selected using Akaike Information Criteria (AIC). The null hypothesis of unit roots is set as:

$$H_0 : \beta_2 = \beta_3 = 0 \tag{4.10}$$

The above setting implies nonstationartity with a deterministic trend rather than a stochastic trend. If the results reject the null hypothesis, then Y_t is stationary, if the results cannot reject the null hypothesis, then Y_t is nonstationary. The results of testing are presented in Table 4.1.

3) Phillips-Perron Unit Root Test

Phillips and Perron (1988) unit root test is a nonparameteric test for detecting the presence of a unit root in a series. ADF unit root testing procedure is not very powerful in finite samples; therefore, the PP test is used as one alternative which modifies the ordinary DF-t test by considering a moving average correction of the Newey-West type of adjusted standard errors. In the first stage of PP test for any time-series, Y_t, the following equation for ordinary DF test is estimated by ordinary least squares:

$$\Delta Y_t = \alpha + \rho\delta T - \rho Y_{t-1} + u_t \tag{4.11}$$

In the second stage, the t-statistic for ρ is corrected by adjusting for variance of u_t.

The results for above three unit roots test are reported in summary in Table 4.1. Full results provided in Appendix C.

Table 4.1 Unit Root Tests

Autocorrelation Function: Mean Value

	Level	1st Difference	2nd Difference
m_0/p	-1.1601	0.099318*	
m_1/p	0.20220	0.10397*	
m_2/p	0.55959	0.12151*	
m_0	3.9920	0.12808*	
m_1	5.3543	0.13274*	
m_2	5.7117	0.15028	0.3742E-3*
y	1.2887	0.073230	-0.6215E-3*
r	1.6243	-0.035698*	
p	5.1521	0.028762	-0.1911E-3*

ADF Test Statistics

Variable	Levels	k lag	1st Differences	k lag
m_0/p	-1.6130	2	-5.4858*	1
m_1/p	-2.1150	1	-6.1677*	1
m_2/p	-1.2280	1	-5.0356*	1
m_0	-1.6516	1	-4.4720*	1
m_1	-1.0657	1	-5.9947*	1
m_2	-1.2106	1	-3.2251*	1
y	-1.4289	3	-6.0775*	2
r	-2.8661	1	-4.0449*	1
p	-1.4912	2	-3.8294*	1

Phillips-Peron Test Statistics

Variable	Levels	t- lag	1st Differences	t-lag
m_0/p	-1.6574	5	-7.2299*	5
m_1/p	-1.3933	5	-11.0110*	5
m_2/p	-0.55393	5	-8.2175*	5
m_0	-0.99072	5	-6.2184*	5
m_1	-0.42686	5	-8.3195*	5
m_2	-0.29793	5	-5.6251*	5
y	-1.2540	5	-9.0609*	5
r	-1.4266	5	-5.8133*	5
p	-0.83052	5	-4.3446*	5

*Rejection of unit root hypothesis, according to Mackinnon's (1991) critical value at 5%., selection based on AIC and SBC criteria, to k lags. 't-lag' is the truncation lag level.
ACF tests reported in Appendix C-1, ADF tests reported in Appendix C-2 and PP tests reported in Appendix C-3.

Table 4.1 indicates that the autocorrelation coefficients are around zero. They show that m_2, y and p is integrated to order of two, the other variables are integrated to order of one. Microfit also provides a graphical plot of the autocorrelation coefficients, and they do not move around zero. The autocorrelation coefficients have statistically significant Q statistics, the series is not stationary. The ADF tests demonstrate that all variables reject the hypothesis of unit roots in their first difference meaning that they are integrated of order 1 at the 5% significance level. The PP tests are superior the ADF test. The PP tests yields similar result as the ADF test that all variables reject the hypothesis of unit roots in their first difference.

Each of the three stationarity tests carried out has provided similar results. These results are summarized in Table 4.2 which demonstrates that all variables are accepted as stationary in the first difference.

Table 4.2 – Summary of Results of Unit Root Tests

Variable	Correlogram	ADF	Phillips-Perron
m_0 / p	I(1)	I(1)	I(1)
m_1 / p	I(1)	I(1)	I(1)
m_2 / p	I(1)	I(1)	I(1)
m_0	I(1)	I(1)	I(1)
m_1	I(1)	I(1)	I(1)
m_2	I(2)	I(1)	I(1)
y	I(2)	I(1)	I(1)
r	I(1)	I(1)	I(1)
p	I(2)	I(1)	I(1)

4.4 Engle-Granger Two-Stage Cointegration Method

In a simple regression, cointegration (CI) analysis is basically an extension of the unit root tests and is applied to the residuals from a long-run structural regression equation. If all the variables included in the same regression are non-stationary, then we must check if they can hold a long-run relation between themselves. Engle-

Granger (1987) pointed out a two-stage test in order to test the equilibrium relationship between the regression variables. EGTS approach is based on the idea of testing for the stationarity of the disequilibrium errors obtained from the long-run regression. If the error terms are found to be stationary, then it is said to be cointegration between the variables. In the first stage, the long-run parameters are estimated. For example, if two variables X_t and Y_t are indeed cointegrated, then the Ordinary Least Squares (OLS) estimators of the long-run parameters will be consistent. The residuals are checked to ensure they are I(0). In the second stage of the Engle-Granger procedure, the residuals from the cointegrating regression, the e_t are used as estimates of the true disequilibrium.

$$\Delta Y_t = lagged(\Delta Y_t, \Delta X_t) - \lambda e_{t-1} + u_t \tag{4.12}$$

Where, the short-run disequilibrium coefficient λ is between zero and one, and represents the speed of adjustment of equation from disequilibrium to equilibrium level. The optimal lag length is important to achieve efficient estimations therefore the optimal lag length is usually selected by Akaike Information Criterion (AIC) or Schwarz Bayesian Criterion (SBC).

In the first stage of OLS estimation, the initial regressions used are Eq. (4.1) and Eq. (4.2) presented above. Two or three first stage regressions are carried out, dropping a variable each time in searching for a cointegration relationship. The results are summarized separately in Tables 4.3.1, 4.3.2 and 4.3.3 to demonstrate both real and nominal money demand with three definitions of money to ascertain their order of integration. The full reports are shown in Appendix-D.

Table 4.3.1 – Engle-Granger Two-stage Method

Panel A: First stage, Long-run					
Eq.(4.1) dependent variable m_0/p			*Eq.*(4.2) dependent variable m_0		
Regressors	(1) y & r	(2) y	(1) y, r &p	(2) y & r	(3) y
Constant	-3.0918 (27.6858)	-2.9213 (-64.9540)	-4.6305 (-7.2240)	1.2191 (6.9726)	1.6535 (22.5292)
y	1.3827 (49.8595)	1.3667 (51.6851)	1.2140 (16.3598)	1.8556 (42.7339)	1.8146 (42.0531)
r	0.092218 (1.6624)		0.041262 (0.72498)	0.23497 (2.7054)	
p			1.3569 (9.2547)		
Panel B: Diagnostic Tests					
	R^2=0.98225	R^2=0.98127	R^2=0.99110	R^2=0.97555	R^2=0.97197
	DW=0.59907	DW=0.56917	DW=0.56998	DW=0.41638	DW=0.36849
	χ^2_{SC} (1)=25.3637	χ^2_{SC} (1)=26.6963	χ^2_{SC} (1)=26.3426	χ^2_{SC} (1)=33.1190	χ^2_{SC} (1)=35.2431
	χ^2_{FC} (1)=0.32489	χ^2_{FC} (1)=0.27473	χ^2_{FC} (1)=16.2919	χ^2_{FC} (1)=15.2209	χ^2_{FC} (1)=11.5221
	χ^2_{N} (2)=39.3736	χ^2_{N} (2)=20.3059	χ^2_{N} (2)=6.1337	χ^2_{N} (2)=49.9689	χ^2_{N} (2)=9.9352
	χ^2_{H} (1)=8.8090	χ^2_{H} (1)=5.0321	χ^2_{H} (1)=1.6013	χ^2_{H} (1)=3.6456	χ^2_{H} (1)=3.5014
Panel C: Unit root test for residuals					
ADF(x)	(1)= -4.7715	(1)= -4.4366	(1)=-4.4703	(1)=-3.7774	(2) -2.2112
Critical Value	-3.9267	-3.4687	-4.3384	-3.9627	-3.4687

The t-ratios in parenthesis in Panel A. χ^2_{SC}, χ^2_{FC}, χ^2_{N}, χ^2_{H} are lagrange multiplier statistics for, respectively, tests of residual correlation, functional form misspecification, non-normal errors and heteroskedastcity. The statistics are distributed as Chi-squared variates within degrees of freedom in parenthesis in panel B. Panel C reports ADF test statistics to (x) lags, and the Mckinnon critical values.
Full results available in Appendix D-1 and Appendix D-4.

Table 4.3.2 – Engle-Granger Two-stage Method

Panel A: First stage, Long-run					
	Eq.(4.1) dependent variable m_1/p		*Eq.*(4.2). dependent variable m_1		
Regressors	(1) y & r	(2) y	(1) y, r &p	(2) y & r	(3) y
Constant	-1.0466	-1.4911	-1.4920	3.2643	3.0837
	(-12.7513)	(-35.5856)	(-3.0166)	(23.3881)	(55.2685)
y	1.2721	1.3140	1.2232	1.7499	1.7619
	(62.4118)	(53.3363)	(21.3645)	(50.3431)	(53.7114)
r	-0.24046		-0.25522	-0.097709	
	(-5.8980)		(-5.8115)	(-1.4093)	
p			1.1033		
			(9.7523)		
Panel B: Diagnostic Tests					
	R^2=0.98961	R^2=0.98239	R^2=0.99432	R^2=0.98329	R^2=0.98263
	DW=0.43662	DW=0.28715	DW=0.41755	DW=0.32557	DW=0.31715
	χ^2_{SC}(1)=31.6106	χ^2_{SC}(1)=36.3199	χ^2_{SC}(1)=32.3857	χ^2_{SC}(1)=37.2042	χ^2_{SC}(1)=37.2705
	χ^2_{FC}(1)=2.7054	χ^2_{FC}(1)=1.5318	χ^2_{FC}(1)=15.4396	χ^2_{FC}(1)=9.3591	χ^2_{FC}(1)=9.6917
	χ^2_{N}(2)=4.7271	χ^2_{N}(2)=0.94512	χ^2_{N}(2)=2.5925	χ^2_{N}(2)=29.5866	χ^2_{N}(2)=36.3989
	χ^2_{H}(1)=0.00477	χ^2_{H}(1)=0.75826	χ^2_{H}(1)=5.0114	χ^2_{H}(1)=4.8836	χ^2_{H}(1)=5.5308
Panel C: Unit root test for residuals					
ADF(x)	(1)=-4.0112	(1)=-4.0222	(1)=-3.8712	(2)=-2.1449	(2) -2.2905
Critical Value	-3.9267	-3.4687	-4.3384	-3.9267	-3.4687

The t-ratios in parenthesis in Panel A. χ^2_{SC}, χ^2_{FC}, χ^2_{N}, χ^2_{H} are lagrange multiplier statistics for, respectively, tests of residual correlation, functional form misspecification, non-normal errors and heteroskedastcity. The statistics are distributed as Chi-squared variates within degrees of freedom in parenthesis in panel B. Panel C reports ADF test statistics to (x) lags, and the Mckinnon critical values.
Full results available in Appendix D-2 and Appendix D-5.

Table 4.3.3 – Engle-Granger Two-stage Method

Panel A: First stage, Long-run					
	Eq.(4.1). dependent variable m_2/p		*Eq.*(4.2). dependent variable m_2		
Regressors	(1) y & r	(2) y	(1) y, r &p	(2) y & r	(3) y
Constant	-1.3174 (-12.9828)	-1.5177 (-36.5010)	-4.1507 (-9.0185)	2.9935 (16.0604)	3.0571 (41.7783)
y	1.5931 (63.2186)	1.6120 (65.9380)	1.2824 (24.0689)	2.0659 (44.6330)	2.0599 (47.8816)
r	-0.10835 (-2.1496)		-0.20217 (-4.9474)	0.034402 (0.37157)	
p			1.6582 (15.7418)		
Panel B: Diagnostic Tests					
	R^2=0.98939	R^2=0.98841	R^2=0.99642	R^2=0.97830	R^2=0.97824
	DW=0.38988	DW=0.36977	DW=0.47325	DW=0.24611	DW=0.24469
	$\chi^2_{SC}(1)$=34.2688	$\chi^2_{SC}(1)$=34.7219	$\chi^2_{SC}(1)$=30.3858	$\chi^2_{SC}(1)$=41.0253	$\chi^2_{SC}(1)$=40.8082
	$\chi^2_{FC}(1)$=4.5462	$\chi^2_{FC}(1)$=4.4812	$\chi^2_{FC}(1)$=14.6275	$\chi^2_{FC}(1)$=18.9009	$\chi^2_{FC}(1)$=18.3648
	$\chi^2_{N}(2)$=19.7143	$\chi^2_{N}(2)$=23.9674	$\chi^2_{N}(2)$=2.6974	$\chi^2_{N}(2)$=8.5857	$\chi^2_{N}(2)$=7.1404
	$\chi^2_{H}(1)$=1.5871	$\chi^2_{H}(1)$=0.70450	$\chi^2_{H}(1)$=3.9666	$\chi^2_{H}(1)$=3.1405	$\chi^2_{H}(1)$=3.0910
Panel C: Unit root test for residuals					
ADF(x)	(1)=-3.4775	(1)=-2.6277	(1)=-3.7809	(2)=-1.8520	(2) -1.8196
Critical Value	-3.9267	-3.4687	-4.3384	-3.9267	-3.4687

The t-ratios in parenthesis in Panel A. χ^2_{SC}, χ^2_{FC}, χ^2_{N}, χ^2_{H} are lagrange multiplier statistics for, respectively, tests of residual correlation, functional form misspecification, non-normal errors and heteroskedastcity. The statistics are distributed as Chi-squared variates within degrees of freedom in parenthesis in panel B. Panel C reports ADF test statistics to (x) lags, and the Mckinnon critical values.
Full results available in Appendix D-3 and Appendix D-6.

The estimations show that each of above regression suffers from the severe serial correlation problem in which χ^2_{SC} has high value. The ADF tests show that the residuals are not stationary for most equations except for money demand for real money m_1 and m_0. However, the coefficients of interest rate have the wrong sign for m_0.

In the second stage of the EGTS method, following equation is used:

$$\Delta m_t = lagged(\Delta m_t,\ \Delta y_t,\ \Delta r_t) - \lambda e_{t-1} + u_t \qquad (4.13)$$

AIC and SBC criteria are used in order to select the appropriate lag length. The results are reported in Tables 4.4.1, 4.4.2 and 4.4.3

Table 4.4.1 –Engle-Granger two stage method

Second stage				
Dependent variable $\Delta(m_0 / p)$			Dependent variable Δm_0	
Model Selection Criteria				
Regressors	AIC (0,0,0,)	SBC (0,0,0,)	AIC (0,0,0,0)	SBC (0,0,0,0)
Δy_t	0.04653 (0.25593)	0.04653 (0.25593)	0.092486 (0.46315)	0.092486 (0.46315)
Δr_t	0.10629 (1.2280)	0.10629 (1.2280)	0.12953 (1.3249)	0.12953 (1.3249)
Δp_t			0.16743 (0.54045)	0.16743 (0.54045)
Constant	0.098861 (5.0321)	0.098861 (5.0321)	0.092036 (3.7363)	0.092036 (3.7363)
e_{t-1}	-0.21108 (-2.7493)	-0.21108 (-2.7493)	-0.22733 (-2.4734)	-0.22733 (-2.4734)
$\bar{R}^2$	0.090621	0.090621	0.047563	0.047563
DW	1.8060	1.8060	1.7755	1.7755

The t-ratios in parenthesis. Full results available in Appendix D-1 and Appendix D-4.

Table 4.4.2 –Engle-Granger two stage method

Second stage				
Dependent variable $\Delta(m_1 / p)$			Dependent variable Δm_1	
Model Selection Criteria				
Regressors	AIC (1,0,0,)	SBC (0,0,0,)	AIC (1,0,0,0)	SBC (0,0,0,0)
$\Delta(m / p)_{t-1}$	0.17883 (1.6924)			
Δm_{t-1}			0.18186 (1.4359)	
Δy_t	0.54228 (4.4062)	0.56971 (4.5779)	0.55843 (4.1171)	0.59786 (4.4488)
Δr_t	-0.15575 (-2.7090)	-0.16332 (-2.73932)	-0.14322 (-2.2708)	-0.16353 (-2.6298)
Δp_t			0.93106 (3.5856)	1.1323 (5.1199)
Constant	0.042760 (2.5804)	0.059296 (4.3432)	0.038764 (1.9561)	0.053626 (3.1366)
e_{t-1}	-0.21415 (-3.0099)	-0.23468 (-3.2815)	-0.23345 (-3.0117)	-0.24467 (-3.1357)
$\bar{R}^2$	0.48354	0.46261	0.44671	0.43365
DW	1.8502	1.4602	1.7950	1.4681

The t-ratios in parenthesis. Full results available in Appendix D-2 and Appendix D-5.

Table 4.4.3 –Engle-Granger two stage method

Second stage				
Dependent variable $\Delta(m_2 / p)$			Dependent variable Δm_2	
Model Selection Criteria				
Regressors	AIC (0,0,0,)	SBC (0,0,0,)	AIC (0,0,0,0)	SBC (1,0,0,0)
$\Delta(m/p)_{t-1}$	0.23536 (1.8239)			
Δm_{t-1}			0.35737 (2.6485)	0.33770 (2.7142)
Δm_{t-2}			0.21552 (1.6761)	
Δy_t	0.70250 (4.7915)	0.57414 (4.5877)	0.50046 (3.8147)	0.55096 (4.1147)
Δy_{t-1}	-0.31785 (-1.8252)			
Δr_t	-0.12442 (-2.1974)	-0.14910 (-2.5825)	-0.088540 (-1.4565)	-0.073357 (-1.1742)
Δr_{t-1}			0.15475 (2.2397)	
Δp_t			0.49058 (1.6950)	0.88596 (3.4769)
Constant	0.044023 (2.2338)	0.075924 (5.5157)	0.019004 (0.89780)	0.033374 (1.6789)
e_{t-1}	-0.13343 (-2.0760)	-0.15017 (-2.6957)	-0.23183 (-2.9845)	-0.19302 (-2.4186)
$\overline{R}^2$	0.4386	0.39211	0.55449	0.51047
DW	1.9471	1.4325	2.0450	2.1017

The t-ratios in parenthesis. Full results available in Appendix D-3 and Appendix D-6.

The error terms from the above regressions have low $\overline{R}^2$, the diagnostic statistics are satisfactory, and the disequilibrium error terms e_{t-1} are correctly signed and statistically significant. The EGTS method shows that there is no cointegration relationship between the variables except real narrow money demand m_1.

4.5 Pesaran *et al*. (2001) ARDL Cointegration Procedure

The above EGTS method does not work and there is no cointegration relationship between the variables. In this section, the bounds testing of cointegration procedure of Pesaran *et al.* (2001) will be applied to the money demand functions.

As discussed in chapter 2, the bounds testing have been increasingly popular amongst the researchers in recent empirical investigations of the demand for money functions (Bahmani-Okskooee and Ng 2002; Halicioglu and Ugur, 2005). There is no previous empirical evidence on studies of money demand in China using Pesaran method. Autoregressive distributed lag (ARDL) procedure of Pesaran *et al.* (2001) has certain econometric advantages in comparison to the other cointegration procedures. The Pesaran et al. (2001) bounds testing approach to cointegration has the following advantages: the endogeneity problem is eliminated; long-run and short-run parameters of the model are estimated simultaneously; it can be applied with explanatory variables regardless of whether they are I(0), I(1) or fractionally integrated; and the small sample size properties of this approach is more robust.

The ARDL representation of Eq. (4.2) is formulated as follows:

$$\Delta m_t = \alpha_0 + \sum_{i=1}^{k} \alpha_{1i} \Delta m_{t-i} + \sum_{i=0}^{k} \alpha_{2i} \Delta y_{t-i} + \sum_{i=0}^{k} \alpha_{3i} \Delta r_{t-i} + \sum_{i=0}^{k} \alpha_{4i} \Delta p_{t-i} + \alpha_5 m_{t-1} +$$
$$\alpha_6 y_{t-1} + \alpha_7 r_{t-1} + \alpha_8 p_{t-1} + u_t \qquad (4.14)$$

The bound testing is based on F statistics, the null hypothesis of no cointegration is defined by $H_0 : \alpha_5 = \alpha_6 = \alpha_7 = \alpha_8 = 0$. The F-statistic has a non-standard distribution. Pesaran *et al.* provide two sets of asymptotic critical values. One set assumes that all variables are I(0) whilst the other assumes they are I(1). If the computed F-statistic falls above the upper bound critical value, then the null of no cointegration is rejected. If it falls below the lower bound, then the null cannot be rejected. However, if it falls inside the critical value band, the result would be inconclusive. Once cointegration is confirmed, it moves to the second stage and estimate the long-run coefficients of the money demand function and the associated ARDL error correction models:

$$\Delta m_t = \alpha_0 + \sum_{i=1}^{k} \alpha_{1i} \Delta m_{t-i} + \sum_{i=0}^{k} \alpha_{2i} \Delta y_{t-i} + \sum_{i=0}^{k} \alpha_{3i} \Delta r_{t-i} + \sum_{i=0}^{k} \alpha_{4i} \Delta p_{t-i} + \lambda e_{t-1} + u_t \tag{4.15}$$

In the long-run, all variables are expected to assume their equilibrium values. The ECM is derived from ARDL. ECM involves differences of each variables plus the lagged value of the error correction (EC) term. The EC term is the residuals obtained from the cointegration regression and is lagged one period in the formulation. According to the Granger Representation Theorem (1987), if the variables in a regression are non-stationary at level but I(1) at difference and then they are cointegrated, it also makes the formulation of ECM is meaningful. The ECM method is applied to see the impacts of monetary policy changes.

In estimating the money demand function by ARDL method when the lag included, the initial lag level selected as two in order to minimize the loss of degree of freedom. In the first stage of ARDL procedure, the order of lags on the first differenced variables is obtained from unrestricted vector autoregression (VAR) using Akaike's information criterion (AIC) and Schwarz Bayesian Criterion (SBC). Next the F-tests are carried out. The results of the F-statistics are reported in Table 4.5 which shows that there is no strong evidence of cointegration. Following previous studies in this area, the results are considered preliminary since the choice of lag length was arbitrary. Table 4.5 indicates that it is significant for i=2 for nominal money demand of m_0, and m_1 at 95% level. These results appear to provide evidence for the existence of a long-run money demand equation.

Table 4.5 F-statistics for Testing the Existence of a Long-Run Money Demand

Order of lag	F-statistics (Without Dummy)			F-statistics (With Dummy)		
	m_0/p	m_1/p	m_2/p	m_0/p	m_1/p	m_2/p
1	2.2106	1.9172	2.5379	3.9439*	1.7674	2.1280
2	1.9040	2.5559	3.0178	3.6231	2.1466	2.4560
3	0.036346	2.1786	3.3252	0.65767	1.8833	3.0610
	F-statistics (Without Dummy)			F-statistics (With Dummy)		
	m_0	m_1	m_2	m_0	m_1	m_2
1	3.5582	4.8317**	3.3272	3.1948	2.7085	2.9057
2	5.3249**	4.9833**	3.4070	4.9178**	4.3499**	2.9808
3	1.5977	2.4307	4.7444**	2.1897	2.7403	4.4294**

Notes: The relevant critical value bounds are obtained from Table C1.iii (with an unrestricted intercept and no trend, with three regressors) in Pesaran *et al.*(2001). They are 2.72-3.77 at 90%, and 3.23-4.35 at 95%. * denotes that the F-statistic falls above 90% upper bound and ** denotes above the 95% upper bound. Full results available in Appendix E and Appendix F

For testing the long-run money demand function, the initial regressions of Eq. (4.1) and Eq. (4.2) are used. The dummy variable D is also added in each equation to make comparison with and without dummy to highlight the influences of economic reform. The following Tables summarize the results of the regressions on the basis of different lag selection criteria for comparison purpose for each definition of money. Table 4.6.1 shows estimation results for both real and nominal money demand for m_0 with and without the dummy variable. Table 4.6.2 in the same way shows the estimation results for real and normal money demand of m_1, and Table 4.6.3 demonstrates the results for real and normal money demand of m_2. Full report can be found in Appendix E and Appendix F. In searching of finding the optimal length of the level variables of the long-run coefficients, several lag selection criteria such as the adjusted $\overline{R}^2$, AIC, SBC and Hannan-Quinn Criterion (HQC) were utilized.

Table 4.6.1 – ARDL Estimations

	Dependent variable m_0/p			Dependent variable m_0		
Panel A: the long-run results (without dummy variable)						
	$\overline{R}^2$ (1,2,2)	AIC (1,1,0)	SBC,HQC (1,0,0)	$\overline{R}^2$ (1,2,2,2)	AIC (1,1,0,1)	SBC,HQC (1,1,0,0)
Constant	-2.8808 (-11.1544)	-2.7257 (-7.6635)	-2.6398 (-5.5668)	2.4688 (0.32701)	1.4821 (0.2800)	3.1770 (0.47757)
y	1.4716 (21.8664)	1.4834 (16.5412)	1.4714 (13.1919)	2.2333 (2.0905)	2.0563 (2.7638)	2.4369 (2.4311)
r	0.16651 (1.3176)	0.11551 (0.73107)	0.085534 (0.42363)	0.61290 (0.93936)	0.37715 (0.87719)	0.75795 (1.2727)
p				-0.27154 (-0.15478)	0.029947 (0.025238)	-0.44865 (-0.29267)
Panel B: the short-run diagnostic tests						
R^2	0.99595	0.99556	0.99535	0.99792	0.99763	0.99753
DWh	0.66195	0.77175	0.87134	-0.68348	0.15668	0.23584
$\chi^2_{SC}(1)$	0.29777	0.43184	0.65540	0.29004	0.0043251	0.013034
$\chi^2_{FC}(1)$	2.2243	1.4615	1.0124	2.5674	1.3404	2.0965
$\chi^2_{N}(2)$	1.5924	4.1891	1.6852	1.5799	6.3403	6.4908
$\chi^2_{H}(1)$	0.54463	1.1642	2.8761	3.8736	1.8540	2.6152
Panel A: the long-run results (with additional dummy variable)						
	$\overline{R}^2$ (1,2,2,0)	AIC (1,1,0,0)	SBC,HQC (1,0,0,0)	$\overline{R}^2$ (2,2,2,2,0)	AIC (1,1,0,1,0)	SBC,HQC (1,0,0,1,0)
Constant	-2.5956 (-8.3478)	-2.3859 (-6.0346)	-2.2308 (-4.2666)	-1.7067 (-0.46765)	-2.8253 (2.1618)	-3.9207 (-2.1091)
y	1.1361 (7.3008)	1.0934 (6.4185)	0.98870 (4.4237)	1.2563 (2.9498)	1.0595 (3.1768)	0.82613 (2.9200)
r	0.013258 (0.097780)	-0.085041 (-0.50871)	-0.15903 (-0.74039)	0.23574 (0.66299)	-0.045966 (-0.20085)	-0.21937 (-1.1166)
p				0.77376 (0.93754)	1.0841 (2.1326)	1.3715 (3.3144)
D	0.79666 (2.0503)	0.89659 (2.1496)	1.1136 (1.9852)	1.0355 (1.5402)	0.93319 (2.1618)	0.99591 (2.2221)
Panel B: the short-run diagnostic tests						
R^2	0.99672	0.99632	0.99613	0.99831	0.99798	0.99789
DWh	-0.62849	-0.34133	-0.12174	2.2499	-0.36034	0.0065562
$\chi^2_{SC}(1)$	0.45871	0.14324	0.025332	3.1384	0.15940	0.0010370
$\chi^2_{FC}(1)$	0.027022	0.094903	0.27140	0.96935	0.42693	0.29251
$\chi^2_{N}(2)$	1.8733	6.3244	3.1794	0.97729	5.8312	2.6124
$\chi^2_{H}(1)$	2.2145	2.5650	4.9129	3.8607	1.4824	1.9457

Maximum lag set to 1. The t-ratios in parenthesis in Panel A. χ^2_{SC}, χ^2_{FC}, χ^2_{N}, χ^2_{H} are lagrange multiplier statistics for, respectively, tests of residual correlation, functional form misspecification, non-normal errors and heteroskedastcity. The statistics are distributed as Chi-squared variates within degrees of freedom in parenthesis in panel B.

Full results available in Appendix E-1, Appendix E-4, Appendix F-1 and Appendix F-4.

Table 4.6.2 – ARDL Estimations

Panel A: the long-run results (without dummy variable)

	Dependent variable m_1/p			Dependent variable m_1		
	$\overline{R}^2$, AIC (2,2,1)	HQC (2,1,1)	SBC (1,0,0)	$\overline{R}^2$ (2,2,1,2)	AIC (1,0,1,2)	SBC,HQC (1,0,1,0)
Constant	-1.0073 (-6.3509)	-0.96873 (-4.9699)	-0.93712 (-7.2539)	1.2658 (0.49372)	3.3515 (0.62281)	2.7931 (0.74892)
y	1.2935 (31.9351)	1.2898 (25.9897)	1.3002 (40.1035)	1.7034 (3.9697)	2.1036 (2.2095)	1.9531 (3.3855)
r	-0.16860 (-2.0918)	-0.17458 (-1.7673)	-0.19412 (-3.0175)	0.20028 (0.49505)	0.56812 (0.63471)	0.36950 (0.82499)
p				0.40962 (0.64037)	-0.11627 (-0.085793)	0.045063 (0.049928)

Panel B: the short-run diagnostic tests

R^2	0.99787	0.99777	0.99732	0.99894	0.99881	0.99865
DWh	1.9145	1.8681	2.3666	1.9518	1.1315	2.1359
$\chi^2_{SC}(1)$	0.43640	1.0435	4.7729	0.11463	0.90467	3.5386
$\chi^2_{FC}(1)$	0.33799	0.038681	0.011258	0.22749	0.010625	0.0053349
$\chi^2_{N}(2)$	2.3501	2.3694	8.3647	1.3978	6.1066	4.8285
$\chi^2_{H}(1)$	2.3127	1.6434	0.71305	3.0188	1.7727	1.0112

Panel A: the long-run results (with additional dummy variable)

	HQC (1,1,1,0)	$\overline{R}^2$, AIC (2,2,1,0)	SBC (1,0,1,0)	$\overline{R}^2$ (2,2,1,2,0)	AIC (1,2,1,2,0)	SBC,HQC (1,0,0,0,0)
Constant	-0.75975 (-4.5534)	-0.85190 (-5.9023)	-0.80134 (-5.8847)	-1.0753 (-0.89433)	-0.96569 (-0.75695)	-1.3795 (-1.6123)
y	1.0908 (13.1715)	1.1153 (15.2263)	1.1268 (17.3060)	1.1176 (5.7157)	1.1315 (5.4810)	1.1074 (7.7205)
r	-0.28526 (-3.5579)	-0.26295 (-3.7175)	-0.26839 (-4.0091)	-0.16061 (-0.92463)	-0.13404 (-0.71593)	-0.17719 (-1.8233)
p				1.0288 (3.5195)	1.0068 (3.2504)	1.1028 (5.4734)
D	0.48341 (2.6394)	0.41572 (2.6206)	0.41672 (2.8794)	0.50139 (2.4317)	0.53842 (2.4308)	0.45544 (2.8476)

Panel B: the short-run diagnostic tests

R^2	0.99803	0.99822	0.99790	0.99911	0.99907	0.99873
DWh	1.9118	1.9146	2.1405	1.9488	1.3704	2.2907
$\chi^2_{SC}(1)$	3.4388	0.3.422	3.9274	0.082325	1.4322	4.1724
$\chi^2_{FC}(1)$	0.96027	0.20870	0.33527	0.20088	0.5747E-3	0.20344
$\chi^2_{N}(2)$	4.0750	2.7229	7.9244	1.7606	1.7828	22.2344
$\chi^2_{H}(1)$	0.39616	0.82609	0.12092	1.0795	0.77602	1.3901

Maximum lag set to 1. The t-ratios in parenthesis in Panel A. χ^2_{SC}, χ^2_{FC}, χ^2_{N}, χ^2_{H} are lagrange multiplier statistics for, respectively, tests of residual correlation, functional form misspecification, non-normal errors and heteroskedastcity. The statistics are distributed as Chi-squared variates within degrees of freedom in parenthesis in panel B.
Full results available in Appendix E-2 , Appendix E-5, Appendix F-2 and Appendix F-5

Table 4.6.3 – ARDL Estimations

Panel A: the long-run results (without dummy variable)				
	Dependent variable m_2/p		Dependent variable m_2	
	$\bar{R}^2$ (2,2,1)	AIC,SBC,HQC (1,1,1)	$\bar{R}^2$ (2,0,2,0)	AIC,SBC,HQC (1,0,1,0)
Constant	-1.4223 (-6.7020)	-1.4269 (-5.5289)	-0.11413 (-0.025346)	6.3364 (0.44909)
y	1.6902 (26.3236)	1.7252 (21.0936)	2.0462 (2.5720)	3.2930 (1.2575)
r	0.13064 (0.97950)	0.19719 (1.1483)	0.53314 (0.73456)	1.7447 (0.71208)
p			0.61206 (0.53342)	-1.0954 (-0.29911)
Panel B: the short-run diagnostic tests				
R^2	0.99872	0.99863	0.99930	0.99926
DWh	1.9256	1.2448	2.0080	1.5315
$\chi^2_{SC}(1)$	0.32529	1.5071	0.016932	1.9499
$\chi^2_{FC}(1)$	0.10016	0.022004	0.26217	0.19947
$\chi^2_{N}(2)$	2.2334	2.2167	14.2152	6.0785
$\chi^2_{H}(1)$	2.2764	1.8280	1.5120	2.1137

Panel A: the long-run results (with additional dummy variable)		
	$\bar{R}^2$, AIC, SBC,HQC (1,1,1,0)	$\bar{R}^2$, AIC, SBC,HQC (1,0,1,0,0)
Constant	-1.1334 (-3.8620)	-1.3325 (-0.47600)
y	1.3987 (8.5843)	1.5630 (3.7695)
r	0.056472 (0.35663)	0.38231 (0.86122)
p		0.94568 (1.3534)
D	0.79736 (1.8471)	0.81412 (1.9064)
Panel B: the short-run diagnostic tests		
R^2	0.99883	0.99936
DWh	0.72417	1.5769
$\chi^2_{SC}(1)$	0.50514	1.9064
$\chi^2_{FC}(1)$	1.9448	0.025566
$\chi^2_{N}(2)$	5.3128	13.5801
$\chi^2_{H}(1)$	0.49300	0.45584

Maximum lag set to 1. The t-ratios in parenthesis in Panel A. χ^2_{SC}, χ^2_{FC}, χ^2_{N}, χ^2_{H} are lagrange multiplier statistics for, respectively, tests of residual correlation, functional form misspecification, non-normal errors and heteroskedastcity. The statistics are distributed as Chi-squared variates within degrees of freedom in parenthesis in panel B.
Full results available in Appendix E-3 , Appendix E-6, Appendix F-3 and Appendix F-6

The preceding long-run results indicate that all the diagnostic tests have good results. The real money demand functions perform better than the nominal money demand function. The equations with the additional dummy variable perform better than without it. This shows that economic reform did bring significant changes after 1978. Comparing three definitions of money, the real money demand m_1 performs better than the other two definitions of money whilst the coefficients of interest rate have the wrong sign for m_0 and m_2.

The ECM regressions estimations results are shown in Tables 4.7.1 to 4.7.6. The estimations are reported in full in Appendix E & Appendix F. To conduct the stability tests on the preferred error correction representation of the ARDL method, the ARDL error correction estimation results and the respective appropriate optimal lag length selection criteria of real and nominal money demand for m_0 with and without a dummy variable are displayed in Table 4.7.1 and 4.7.2. The estimation results of real and nominal money demand for m_1 are displayed in Table 4.7.3 and 4.7.4 and results for m_2 are displayed in Table 4.7.5 and 4.7.6.The Brown *et.al* (1975) regression stability test is performed to see if the long-run relationship estimated from the ARDL cointegration is stable. The graphs of CUSUM and CUSUMSQ presented are the SBC-based error correction model.

Table 4.7.1 – Error Correction Representation of the ARDL Model

Short-run dependent variable Δ (m_0/p) without dummy				Short-run dependent variable Δ m_0 without dummy		
	Eq.(1)	Eq.(2)	Eq.(3)	Eq.(4)	Eq.(5)	Eq.(6)
Regressors	AIC (1,1,0)	SBC/HQC (1,0,0)	$\overline{R}^2$ (1,2,2)	AIC (1,1,01)	SBC/HQC (1,1,0,0)	$\overline{R}^2$ (1,2,2,2)
Δy_t	-0.18971 (-0.10336)	0.21486 (2.1884)	0.15615 (0.70127)	-0.14507 (-0.61705)	-0.32398 (-1.6395)	0.050635 (0.17830)
Δy_{t-1}			-0.28598 (-1.2374)			-0.44197 (-1.5739)
Δr_t	0.021314 (0.69308)	0.012491 (0.40841)	0.17747 (1.7996)	0.049691 (1.1163)	0.092967 (2.9283)	0.12813 (1.1533)
Δr_{t-1}			-0.13032 (-1.3734)			-0.19179 (-1.7765)
Δp_t				0.59803 (1.1974)	-0.055030 (-0.35724)	1.0426 (1.8969)
Δp_{t-1}						-0.52447 (-1.0552)
Constant	-0.50294 (-2.0550)	-0.38549 (-1.6408)	-0.69737 (-2.3741)	0.19528 (0.32905)	0.38968 (0.66960)	0.35109 (0.43194)
e_{t-1}	-0.18452 (-2.4599)	-0.14603 (-2.0447)	-0.24208 (-2.6263)	-0.13175 (-1.5375)	-0.12266 (-1.4217)	-0.14221 (-1.2028)
$\overline{R}^2$		0.051670	0.097725	0.28812	0.27411	0.31289
F-Statistics		1.9081	2.4831	6.592	5.9703	4.6813
DW		1.7901	1.604	1.9653	1.9480	2.1026

Long-run equations

Eq.(1)	$Ecm = m_0/p$ -1.4834*y -0.11551* r+2.7257
Eq.(2)	$Ecm = m_0/p$ -1.4714*y -0.085534*r +2.6398
Eq.(3)	$Ecm = m_0/p$ -1.4726*y -0.16651*r +2.8808
Eq.(4)	$Ecm = m_0$ -2.0563*y -0.37355* r -0.029947*p-1.4821
Eq.(5)	$Ecm = m_0$ -2.4369*y -0.75795*r +0.44865*p -3.1770
Eq.(6)	$Ecm = m_0$ -2.2333* y -0.61290*r +0.27154*p -2.4688

The t-ratios in parenthesis. The signs in the long-run equations must be reversed to show correct results. As HQC and SBC criteria produce exactly the same error correction results, therefore, the later estimations are not reported here.
Full results available in Appendix E-1 and Appendix E-4.

Table 4.7.2 – Error Correction Representation of the ARDL Model

Short-run dependent variable Δ (m_0/p) with dummy				Short-run dependent variable Δ m_0 with dummy		
	Eq.(1)	Eq.(2)	Eq.(3)	Eq.(4)	Eq.(5)	Eq.(6)
Regressors	AIC (1,1,0,0)	SBC/HQC (1,0,0,0)	$\overline{R}^2$ (1,2,2,0)	AIC (1,1,0,1,0)	SBC,HQC (1,0,0,1,0)	$\overline{R}^2$ (2,2,2,2,0)
Δm_t						-0.15844 (-1.0122)
Δy_t	-0.059193 (-0.34919)	0.15979 (1.7312)	0.078265 (0.39487)	-0.10920 (-0.49609)	0.16857 (1.7595)	-0.0078114 (-0.027500)
Δy_{t-1}			-0.26782 (-1.2727)			-0.45880 (-1.7651)
Δr_t	-0.016800 (-0.54264)	-0.025701 (-0.83308)	0.093815 (1.0021)	-0.0093058 (-0.19825)	-0.044762 (-1.1212)	0.13177 (1.2191)
Δr_{t-1}			-0.16846 (-1.9315)			-0.19164 (-1.8518)
Δp_t				0.82384 (1.7375)	1.2288 (3.2385)	1.2638 (2.4358)
Δp_{t-1}						-0.61124 (-1.3254)
ΔD_t	0.17713 (3.0434)	0.17998 (3.0497)	0.18593 (-2.2524)	0.18892 (2.7149)	0.20321 (2.9207)	0.19921 (2.8783)
Constant	-0.47135 (-2.0896)	-0.36503 (-1.6634)	-0.60577 (-2.2524)	-0.57198 (-0.91885)	-0.80001 (-1.3174)	-0.32831 (-0.37370)
e_{t-1}	-0.19756 (-2.8549)	-0.16161 (-2.4473)	-0.23339 (-2.7803)	-0.20245 (-2.4039)	-0.20405 (-2.3972)	-0.19237 (-1.5783)
$\overline{R}^2$	0.21690	0.19402	0.25248	0.37816	0.36466	0.25125
F-Statistics	4.7121	4.0090	4.1480	7.4812	6.9397	4.2884
DW	2.0831	2.0301	2.1409	2.0806	1.9985	1.6063

Long-run equations

Eq.(1) $ecm = m_0/p - 1.0934*y + 0.85041*r - 0.89659*D + 2.3859$

Eq.(2) $ecm = m_0/p - 0.98870*y + 0.15903*r - 1.1136*D + 2.2308$

Eq.(3) $ecm = m_0/p - 1.1361*y - 0.13258*r - 0.79666*D + 2.5956$

Eq.(4) $ecm = m_0 - 1.0595*y - 0.045966*r - 1.0841*p - 0.93319*D + 2.8253$

Eq.(5) $ecm = m_0 - 0.82613*y + 0.21937*r - 1.3715*p - 0.99591*D + 3.9207$

Eq.(6) $ecm = m_0 - 1.2563*y - 0.23574*r - 0.77376*p - 1.0355*D + 1.7067$

The t-ratios in parenthesis. The signs in the long-run equations must be reversed to show correct results. As HQC and SBC criteria produce exactly the same error correction results, therefore, the later estimations are not reported here.
Full results available in appendix F-1 and Appendix F-4.

Table 4.7.3 – Error Correction Representation of the ARDL Model

Short-run dependent variable $\Delta\ (m_1/p)$without dummy				Short-run dependent variable $\Delta\ m_1$ without dummy		
	Eq.(1)	Eq.(2)	Eq.(3)	Eq.(4)	Eq.(5)	Eq.(6)
Regressors	AIC/$\overline{R}^2$ (2,2,1)	SBC (1,0,0)	HQC (2,1,1)	AIC/HQC (1,0,1,2)	SBC (1,0,1,0)	$\overline{R}^2$ (2,2,1,2)
Δm_t	0.25303 (2.1195)		0.17962 (1.6378)			0.16789 (1.2951)
Δy_t	0.62524 (4.4682)	0.42781 (5.9438)	0.53523 (4.2366)	0.22807 (2.3671)	0.27300 (3.1422)	0.49116 (2.5489)
Δy_{t-1}	-0.23404 (-1.4257)					-0.32688 (-1.7719)
Δr_t	-0.13515 (-2.2685)	-0.063872 (-2.5971)	-0.14914 (-2.5088)	-0.13506 (-1.9526)	-0.10307 (-1.6062)	-0.13608 (-1.9580)
Δp_t				0.57843 (1.7723)	0.0062989 (0.048697)	0.88083 (2.1908)
Δp_{t-1}				-0.55891 (-1.8268)		-0.75515 (-2.1717)
Constant	-0.25381 (-2.7961)	-0.30834 (-4.0100)	-0.20061 (-2.3964)	0.36337 (1.0730)	0.39043 (1.1302)	0.21352 (0.61027)
e_{t-1}	-0.25198 (-3.3360)	-0.32903 (-5.7571)	-0.20709 (-2.9815)	-0.10842 (-1.1966)	-0.13978 (-1.7471)	-0.16869 (-1.7894)
$\overline{R}^2$	0.47618	0.39851	0.46389	0.45408	0.40721	0.47473
F-Statistics	10.4906	12.0423	12.3160	9.7177	9.8367	7.8841
DW	1.9145	1.3949	1.8681	1.7584	1.5091	1.9518

Long-run equations

Eq.(1)	$ecm = m_1/p$ -1.2935*y +0.16860*r +1.0073
Eq.(2)	$ecm = m_1/p$ -1.3002*y +0.19412*r +0.93712
Eq.(3)	$ecm = m_1/p$ -1.2898*y +0.17458*r +0.96873
Eq.(4)	$ecm = m_1$ -2.1036*y +0.56812*r -0.11627*p-3.3515
Eq.(5)	$ecm = m_1$ -1.9531*y +0.36950*r -0.045063*p-2.7931
Eq.(6)	$ecm = m_1$ -1.7034 *y -0.20028*r -0.40962*p-1.2658

The t-ratios in parenthesis. The signs in the long-run equations must be reversed to show correct results. As HQC and SBC criteria produce exactly the same error correction results, therefore, the later estimations are not reported here.
Full results available in Appendix E-2 and Appendix E-5.

Table 4.7.4 – Error Correction Representation of the ARDL Model

	Short-run dependent variable Δ (m_1/p) with dummy			Short-run dependent variable Δ m_1 with dummy		
	Eq.(1)	Eq.(2)	Eq.(3)	Eq.(4)	Eq.(5)	Eq.(6)
Regressors	AIC/ $\overline{R}^2$ (2,2,1,0)	SBC (1,0,1,0)	HQC (1,1,1,0)	AIC (1,2,1,2,0)	SBC,HQC (1,0,0,0,0)	$\overline{R}^2$ (2,2,1,2,0)
Δm_t	0.22471 (2.0305)					0.14528 (1.2022)
Δy_t	0.59658 (4.6038)	0.35769 (4.9315)	0.52030 (4.3799)	0.52824 (2.9242)	0.33950 (4.4588)	0.54918 (3.0428)
Δy_{t-1}	-0.23859 (-1.5739)			-0.28780 (-1.7011)		-0.32807 (-2.7014)
Δr_t	-0.19374 (-3.3064)	-0.21763 (-3.5946)	-0.21721 (-3.6632)	-0.19208 (-2.8978)	-0.054325 (-1.4398)	-0.18010 (-2.7014)
Δp_t				1.2441 (3.2217)	0.33812 (2.9872)	1.1698 (3.0073)
Δp_{t-1}				-0.76825 (-2.3668)		-0.74504 (-2.3039)
ΔD_t	0.12129 (2.9039)	0.13228 (3.0353)	0.12703 (2.9688)	0.13544 (2.7681)	0.13963 (2.6553)	0.13136 (2.6933)
Constant	-0.24855 (-2.9646)	-0.25436 (-3.4681)	-0.19965 (-2.5385)	-0.24291 (-0.64880)	-0.42293 (-1.3761)	-0.28173 (-0.75383)
e_{t-1}	-0.29175 (-4.1046)	-0.31742 (-5.4181)	-0.26279 (-4.0002)	-0.25154 (-2.6651)	-0.30659 (-4.3901)	-0.26200 (-2.7794)
$\overline{R}^2$	0.55338	0.50594	0.52613	0.54069	0.44260	0.54575
F-Statistics	11.6586	14.0506	15.3783	9.8370	8.9405	8.8838
DW	1.9146	1.4555	1.5272	1.7165	1.4440	1.9488

Long-run equations

Eq.(1) $ecm = m_1/p$ -1.1153*y +0.26295*r -0.41572D+0.85190

Eq.(2) $ecm = m_1/p$ -1.1268*y +0.26839*r -0.41672D+0.80134

Eq.(3) $ecm = m_1/p$ -1.0908*y +0.28526*r -0.48341D+0.75975

Eq.(4) $ecm = m_1$ -1.1315*y +0.13404*r -1.0068*p-0.53842D+0.96569

Eq.(5) $ecm = m_1$ -1.1074*y +0.17719*r -0.1028*p-0.45544D+1.3795

Eq.(6) $ecm = m_1$ -1.1176 *y -0.16061*r -1.0288*p-0.50139D+1.0753

The t-ratios in parenthesis. The signs in the long-run equations must be reversed to show correct results. As HQC and SBC criteria produce exactly the same error correction results, therefore, the later estimations are not reported here.
Full results available in Appendix F-2 and Appendix F-5.

Table 4.7.5 – Error Correction Representation of the ARDL Model

Short-run dependent variable Δ (m_2/p) without dummy			Short-run dependent variable Δ m_2 without dummy	
	Eq.(1)	Eq.(2)	Eq.(3)	Eq.(4)
Regressors	AIC/SBC/HQC (1,1,1)	$\overline{R}^2$ (2,2,1)	AIC/SBC/HQC (1,0,1,0)	$\overline{R}^2$ (2,0,2,0)
Δm_t		0.17470 (1.3688)		0.21548 (1.4546)
Δy_t	0.51672 (4.3133)	0.58952 (4.4282)	0.21853 (2.4996)	0.24666 (2.7716)
Δy_{t-1}		-0.23261 (-1.4809)		
Δr_t	-0.12174 (-2.1932)	-0.11060 (-1.9840)	-0.038540 (-0.70142)	-0.058807 (-0.98311)
Δr_{t-1}				0.072004 (1.0700)
Δp_t			-0.072687 (-0.45098)	0.073779 (0.39492)
Constant	-0.20879 (-2.6962)	-0.25167 (-2.9877)	0.42048 (0.88520)	-0.13758 (-0.024947)
e_{t-1}	-0.14633 (-2.8422)	-0.17694 (-3.0801)	-0.066360 (-0.85665)	-0.12054 (-1.4208)
$\overline{R}^2$	0.45477	0.46493	0.56628	0.56974
F-Statistics	15.5683	10.0892	17.5702	12.2013
DW	1.6758	1.9256	1.6427	2.0080

Long-run equations	
Eq.(1)	$Ecm = m_2/p$ -1.7252*y -0.19719*r +1.4269
Eq.(2)	$Ecm = m_2/p$ -1.6902*y -0.13064*r +1.4223
Eq.(3)	$Ecm = m_2$ -3.2930*y -1.7447*r +1.0954*p-6.3364
Eq.(4)	$Ecm = m_2$ -2.0462*y -0.522141*r -0.61206*p+ 0.11413

The t-ratios in parenthesis. The signs in the long-run equations must be reversed to show correct results. As HQC and SBC criteria produce exactly the same error correction results, therefore, the later estimations are not reported here.
Full results available in Appendix E-3 and Appendix E-6.

Table 4.7.6 – Error Correction Representation of the ARDL Model

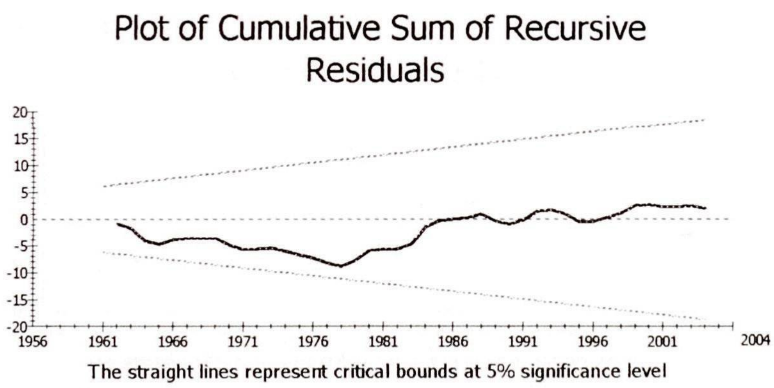
Short-run dependent variable $\Delta (m_2/p)$ with dummy		Short-run dependent variable Δm_2 with dummy
	Eq.(1)	Eq.(2)
Regressors	AIC/ SBC/ $\overline{R}^2$/HQC (1,1,1,0)	AIC/SBC/HQC/ $\overline{R}^2$ (1,0,1,0,0)
Δy_t	0.47571 (4.1953)	0.22823 (2.7848)
Δr_t	-0.17743 (-3.1648)	-0.079630 (-1.4840)
Δp_t		0.13809 (-.81270)
ΔD_t	0.10743 (2.6762)	0.11888 (2.7025)
Constant	-0.15270 (-2.0201)	-0.19456 (-0.38935)
e_{t-1}	-0.13473 (-2.7793)	-0.14602 (-1.8646)
$\overline{R}^2$	0.52044	-0.61956
F-Statistics	15.0656	17.4857
DW	1.8097	1.6339
Long-run equations		
Eq.(1)	$Ecm = m_2/p - 1.3987*y - 0.056472*r - 0.79736D + 1.1334$	
Eq.(2)	$Ecm = m_2 - 1.5630*y - 0.38231*r - 0.94568p - 0.81412\ D + 1.3325$	

The t-ratios in parenthesis. The signs in the long-run equations must be reversed to show correct results. As HQC and SBC criteria produce exactly the same error correction results, therefore, the later estimations are not reported here.
Full results available in Appendix F-3 and Appendix F-6.

The ARDL error correction representation of Eq.(4.15) were estimated. Tables 4.7.1 to 4.7.6 show the results separately of each definition of money with and without dummy variables which enable us to select the most appropriate model of implementing the stability test for the money demand equations. The equations with the additional dummy variable proved again that economic reform brought significant changes to the money demand functions in China. The real money demand m_1 has a better performance than the other two definitions of money. There is cointegration among m_1, y, r and e as the error correction term has expected sign and significant. Therefore, it is expedient to incorporate the short-run dynamics in testing for constancy of long-run parameters.

In this study, the Pesaran et al. (2001) test will be applied along with the Brown *et al.* stability tests. The stability of coefficients of regression equations are normally tested by means of Chow (1960), Hansen (1992), and Hansen and Johansen (1993). The Chow stability test requires *a priori* knowledge of structural breaks in the estimation period and its shortcomings are well documented (Gujarati, 2003). In Hansen (1992) and Hansen and Johansen (1993) procedures, stability tests require I(1) variables and they check the long-run parameter constancy without incorporating the short-run dynamics of a model into the testing. However, it is possible to overcome these shortcomings by employing the Brown *et al.* (1975) stability tests. This stability testing technique is also known as cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests which are based on the recursive regression residuals. The CUSUM and CUSUMSQ statistics are updated recursively and plotted against the break points of the model. Providing that the plot of these statistics fall inside the critical bounds of 5% significance then we assume that the coefficients of a given regression are stable. These tests are usually implemented by means of graphical representation. Next, we will the CUSUM and CUSUMSQ stability test for all error correction models.

Figure 4.1CUSUM and CUSUMSQ Plots for Stability Tests m_0/p without dummy



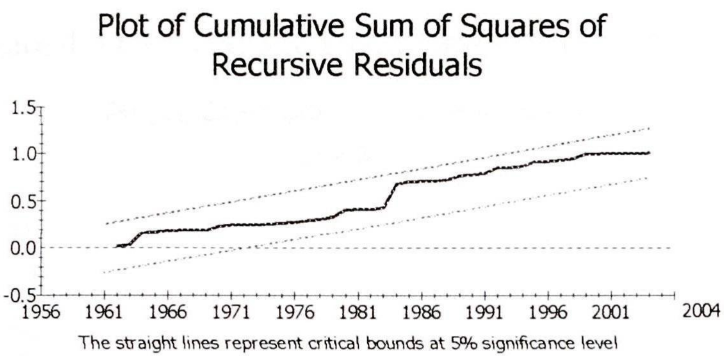
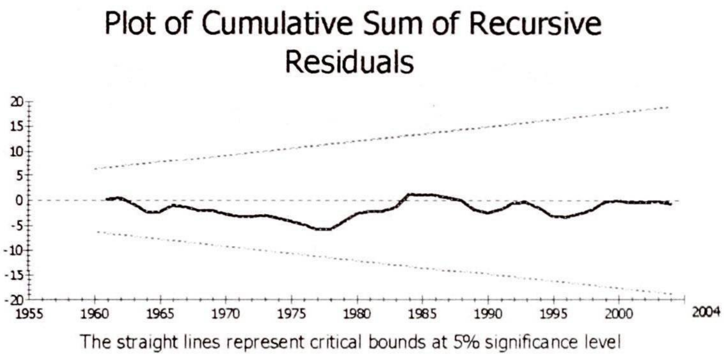


Figure 4.2 CUSUM and CUSUMSQ Plots for Stability Tests m_0 without dummy



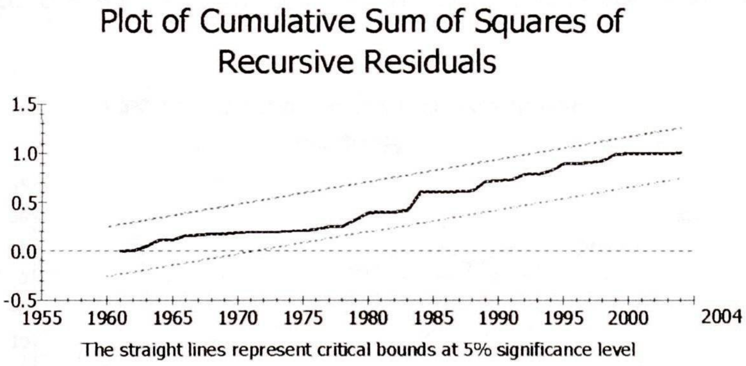
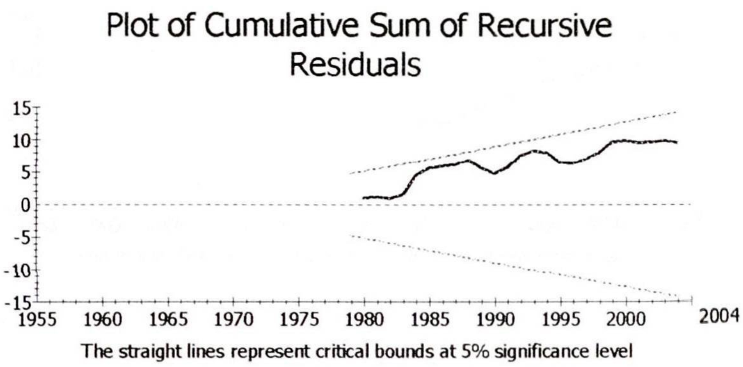


Figure 4.3 CUSUM and CUSUMSQ Plots for Stability Tests m_0/p with dummy



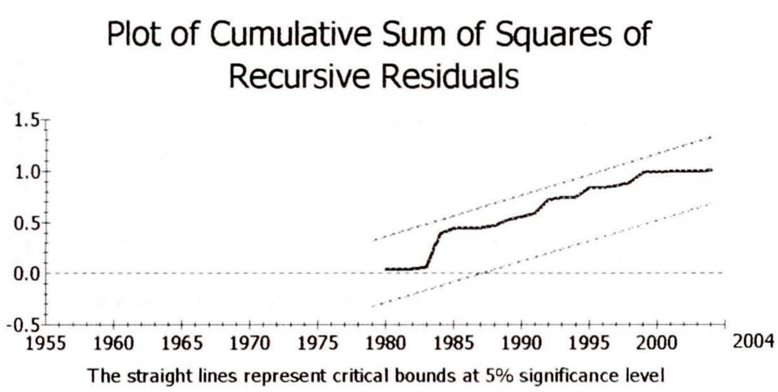
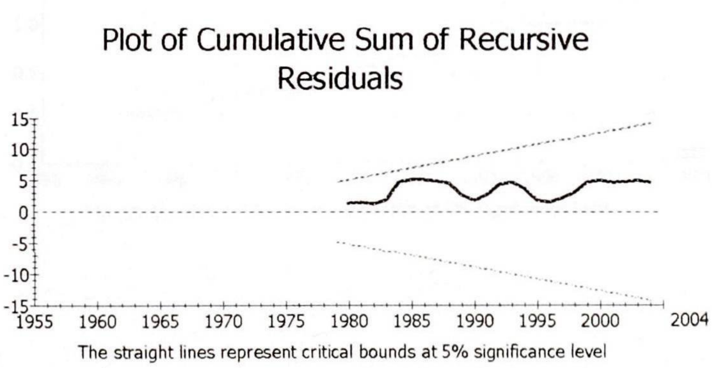


Figure 4.4 CUSUM and CUSUMSQ Plots for Stability Tests m_0 with dummy



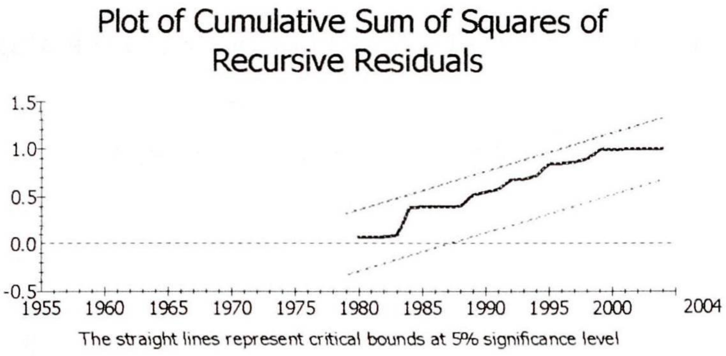
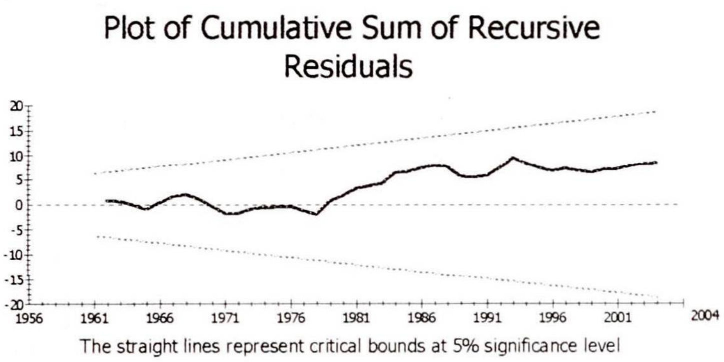


Figure 4.5 CUSUM and CUSUMSQ Plots for Stability Tests m_1/p without dummy



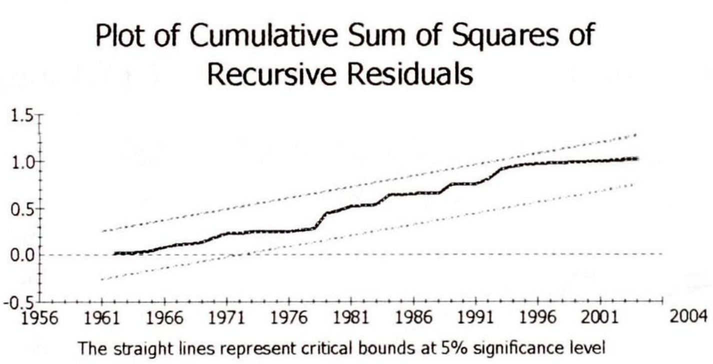


Figure 4.6 CUSUM and CUSUMSQ Plots for Stability Tests m_1 without dummy

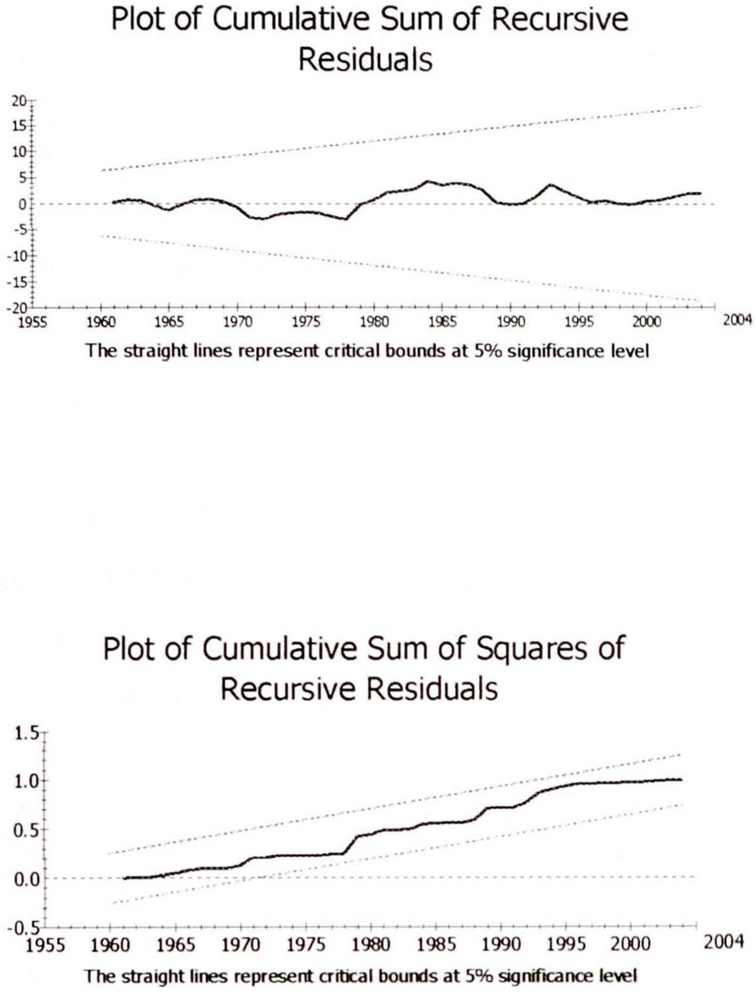
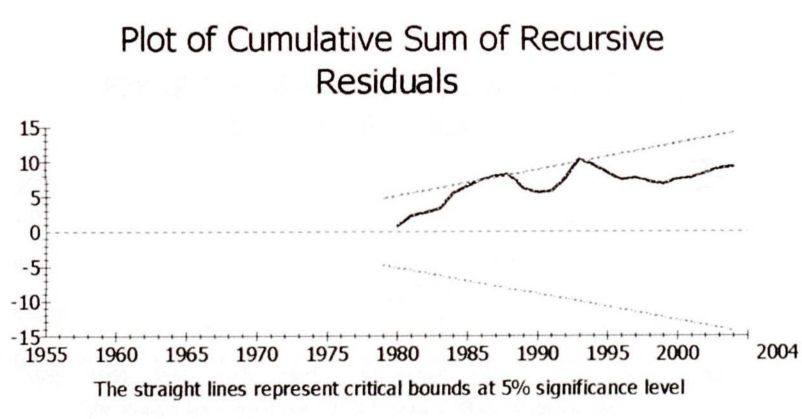


Figure 4.7 CUSUM and CUSUMSQ Plots for Stability Tests m_1/p with dummy



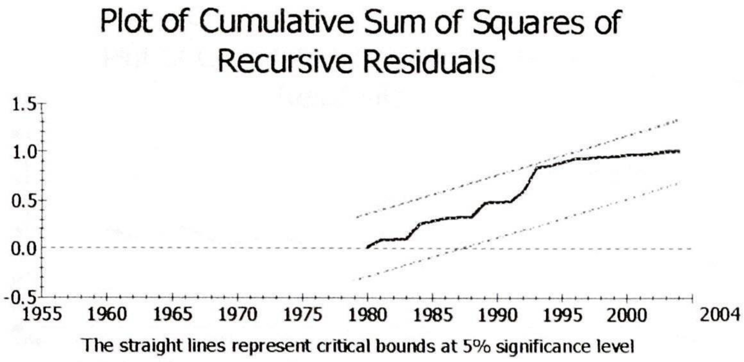
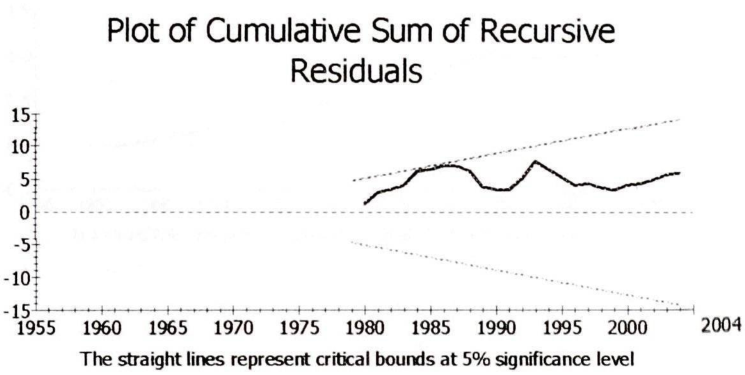


Figure 4.8 CUSUM and CUSUMSQ Plots for Stability Tests m_1 with dummy



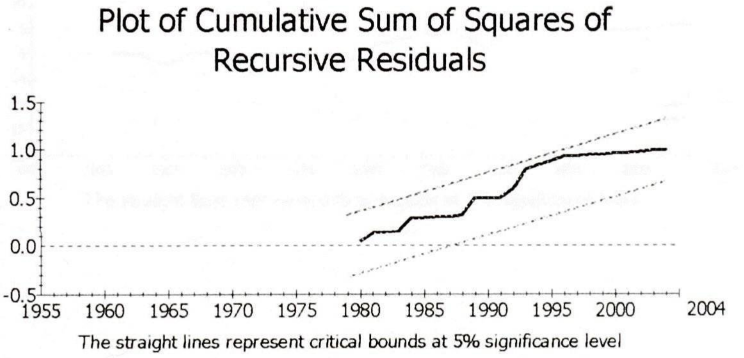
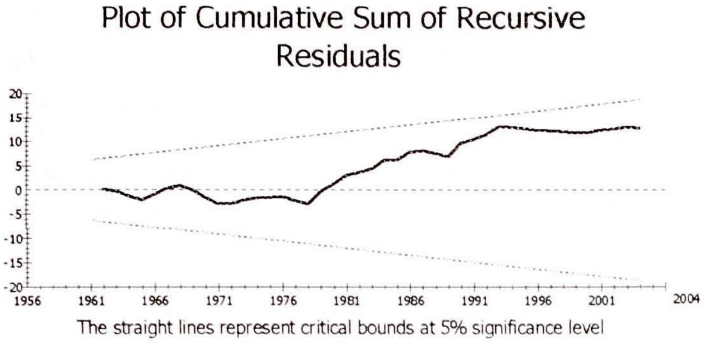


Figure 4.9 CUSUM and CUSUMSQ Plots for Stability Tests m_2/p without dummy



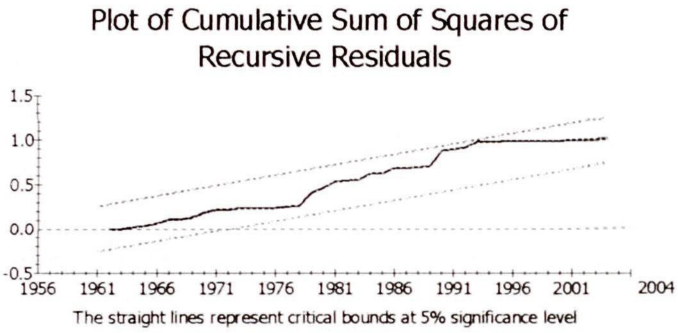
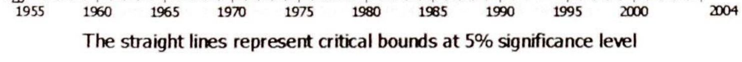


Figure 4.10 CUSUM and CUSUMSQ Plots for Stability Tests m_2 without dummy



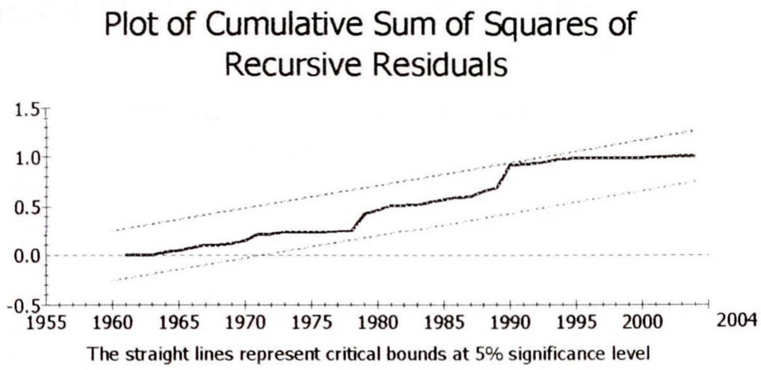
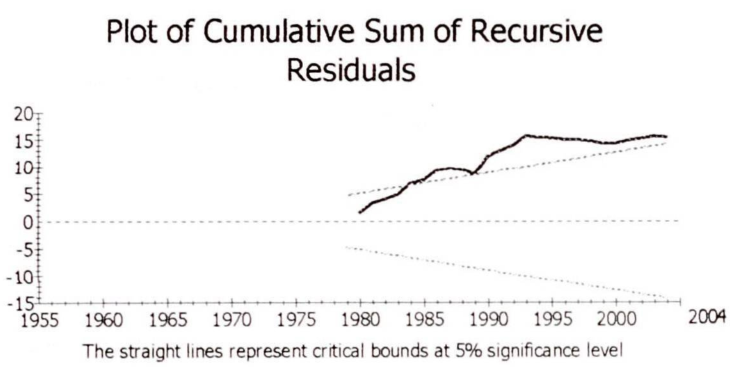


Figure 4.11 CUSUM and CUSUMSQ Plots for Stability Tests m_2/p with dummy



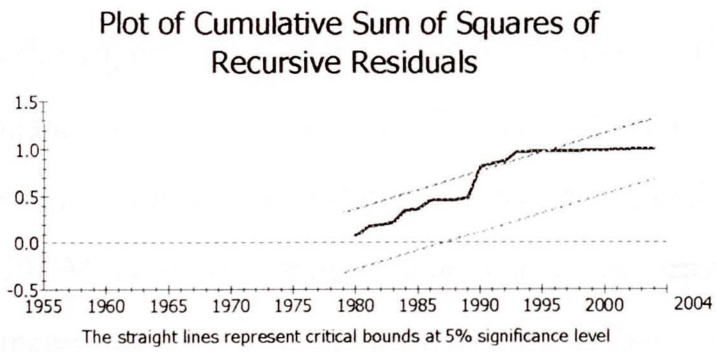
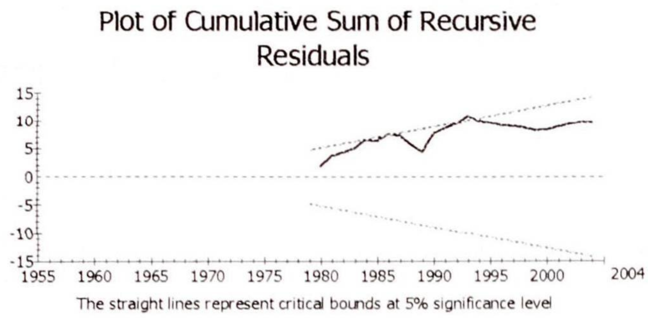
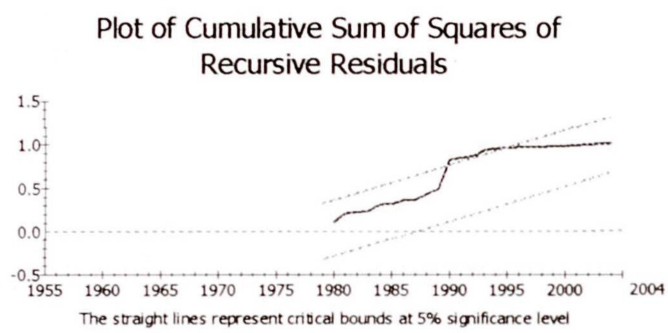


Figure 4.12 CUSUM and CUSUMSQ Plots for Stability Tests m_2 with dummy





As shown above, the plots of CUSUM and CUSUMSQ statistics for real and nominal demand for m_0 and m_1 are all well within the critical bounds implying that all coefficients in the error correction model are stable for m_0 and m_1. The first graph of CUSUM cross the upper bound hence the error correction model for real money demand for m_2 with dummy is not stable. As can be seen the CUSUM and CUSUMSQ graph of nominal money demand for m_2 with dummy crossed over the upper band marginally during 1990-1995 which indicates the economic fluctuation during that period. As analysed in early Chapters, the official inflation rate was quite high in 1995. This gave to a tighter monetary policy by PBC (World Bank, 1996).

The summary results of ARLD long-run estimations are presented in Table 4.8. Table 4.8 indicates that real money demand m_1 presents more satisfactory coefficients compared the other two definition of money.

Table 4.8 – Summary of the Long-Run Results of ARDL Estimations

	Eq.(4.1).		*Eq.*(4.2).	
	Without dummy	With dummy	Without dummy	With dummy
Dependent variable m_0/p			dependent variable m_0	
Constant	-2.7257	-2.3859	1.4821	-2.8253
y	1.4834	1.0934	2.0563	1.0595
r	0.11551	-0.085041	0.37715	-0.045966
p			0.029947	1.0841
D		0.89659		0.93319
Dependent variable m_1/p			dependent variable m_1	
Constant	-1.0073	-0.75975	3.3515	-0.96569
y	1.2935	1.0908	2.1036	1.1315
r	-0.16860	-0.28526	0.56812	-0.13404
p			-0.11627	1.0068
D		0.48341		0.53842
Dependent variable m_2/p			dependent variable m_2	
Constant	-1.4269	-1.1334	6.3364	-1.3325
y	1.7252	1.3987	3.2930	1.5630
r	0.19719	0.056472	1.7447	0.38231
p			-1.0954	0.94568
D		0.79736		0.81412

The above lag selection criteria based on AIC

To get further evidence, the hypothesis testing of income coefficients via the Wald test is performed. The results of testing are provided in Table 4.9 and full test reports can be found in Appendix G. Table 4.9 shows that majority equations do not reject the null hypothesis of the coefficient of y being equal to unity.

Table 4.9 –Hypothesis Testing of Income Coefficients Via Wald Test

	Eq.(4.1)			*Eq.*(4.2).	
	Without dummy	With dummy		Without dummy	With dummy
m_0/p	17.8605[.000]	0.0025567[0.96]	m_0	2.7221 [0.099]	1.6390 [0.20]
m_1/p	85.7400[.000]	3.7050 [0.051]	m_1	2.9056 [0.088]	1.4137 [0.234]
m_2/p	78.6264[.000]	5.9886 [0.014]	m_2	1.2103 [0.271]	2.3828 [0.123]

The values within square brackets represent the probabilities of rejecting the null hypotheses and the values in the front of them denote the test statistics. Full results available in Appendix G.

4.6 Phillips–Hansen Cointegration Approach.

Phillips & Hansen (1990) introduced a cointegration to test the existence of a single long-run relationship between all the variables in a function. The technique is based on the assumption that the dependent variable may follow a time path with a drift or without a drift. This technique relies on the assumption that the variables to be estimated are I(1) and are not themselves cointegrated. The trended case regressions are shown in below Table 4.10, and full results can be found in appendix H.

Table 4.10 – Phillips and Hansen Cointegration Technique

Dependent variable m_0/p			Dependent variable m_0	
	Eq.(4.1)		*Eq.*(4.2)	
Regressors	y, r	y, r &D	y, r& p	y, r, p &D
Constant	-3.2352 (-21.3002)	-3.0999 (-22.3769)	-4.9893 (-6.7639)	-5.2851 (-10.2539)
y	1.4155 (37.3570)	1.3341 (19.6477)	1.1872 (13.8649)	0.98385 (11.3281)
r	0.15715 (2.0468)	0.085954 (1.2169)	0.042096 (0.63592)	-0.060892 (-1.1703)
p			1.4339 (8.5075)	1.5409 (12.6761)
D		0.17307 (1.2218)		0.35462 (3.5582)
Dependent variable m_1/p			Dependent variable m_1	
Constant	-1.1265 (-9.3196)	-0.97848 (-9.1223)	-1.6900 (-2.5633)	-2.1142 (-4.2110)
y	1.2921 (42.8481)	1.1800 (22.4445)	1.1909 (15.5602)	0.97717 (11.5505)
r	-0.20522 (-3.3587)	-0.28290 (-5.1726)	-0.29069 (-4.9131)	-0.39246 (-7.7438)
p			1.1616 (7.7107)	1.2963 (10.9479)
D		0.24934 (2.2732)		0.34828 (3.5875)
Dependent variable m_2/p			Dependent variable m_2	
Constant	-1.4357 (-8.7617)	-1.3764 (-8.3813)	-4.3950 (-6.9417)	-4.7306 (-9.7511)
y	1.6213 (39.6583)	1.6028 (19.9123)	1.2506 (17.0158)	1.0646 (13.0233)
r	-0.056971 (-0.68780)	-0.088653 (-1.0587)	-0.22551 (-3.9691)	-0.31585 (-6.4496)
p			1.7204 (11.8919)	1.8310 (16.0024)
D		0.031707 (0.18881)		0.31070 (3.3121)

The t-ratios are in parenthesis. Full results are available in Appendix H.

The coefficients have the correct signs, except those for inflation rate and interest rate for m_0. T-ratios are good. The above Phillip-Hansen cointegration approach gives further approval that a long-run relationship exists between the variables in the money demand function. From Phillip-Hansen approach, it is found that real narrow money m_1 is the most appropriate money demand model in China for the long-run. This approach is formulated differently depending whether the variables are trended or not. The results for drifted and non-drifted were calculated, and both are found to be quite similar.

4.7 Johansen's Cointegration Approach.

In the above estimations, Pesaran *et al.* (2001) and Phillip-Hansen cointegration approaches provide significant explanation of money demand function in China. In contrast, Johansen (1988) and Johansen and Juselius (1990) could provide a procedure to examine the question of cointegration in a multivariate setting. The Johansen method is necessary for testing uniqueness of CI vector in any multiple regressions. The Johansen-Juselius estimation method is based on the error correction representation of the Vector Auto Regression (VAR) model with Gaussian errors. The Johansen approach is considered to be robust. There are two likelihood testing methods by the Johansen method. One is based on the *maximal eigenvalues*, another is based on the *trace* of the stochastic matrix, testing for the null hypothesis that at most r vectors exist against the alternative of r or more vectors. The AIC and SBC criteria are used to determine the appropriate order of VAR, and then the characteristic roots are used to determine the number of cointegrating relationship in the model, applying eigenvalue and maximal trace tests. A general VAR model with the lag length p can be expressed in the vector form as follows:

$$\Delta X_t = \Pi_0 + \Pi_1 \Delta X_{t-1} + \Pi_2 X_{t-2} + \ldots + \Pi_{p-1} \Delta X_{t-p+1} + \pi X_{t-p} + BZ_t + u_t \qquad (4.16)$$

Where X_t represents m x 1 vector of I(1) variables, Z_t stands for s x 1 vector of I(0) variables, Π_s are unknown parameters and u_t is the error term. The hypothesis is that π has a reduced rank $r < m$ is tested using the trace and maximum eigenvalues test statistics.

On the implementing the Johansen maximum likelihood co-integration approach, the lag structure of the VAR system is selected on the basis of AIC and SBC values which are reported in Table 4.11.

Table 4.11 – The Order of the VAR Model

Without dummy						
Variable	(m_0/p)		(m_1/p)		(m_2/p)	
	AIC	SBC	AIC	SBC	AIC	SBC
4	116.2398	79.3493	129.0848	92.1943	131.4734	94.5829
3	115.3843	87.0070	125.9589	97.5816	128.9777	100.6004
2	117.1486	97.2845	125.9840	106.1199	126.2120	106.3479
1	104.8975	93.5465	120.2195	108.8686	121.0885	109.7376
0	-100.3775	-103.2152	-80.6819	-83.5196	-95.6216	-98.4594
Variable	m_0		m_1		m_2	
4	228.4506	164.1287	242.1410	177.8191	250.4584	186.1365
3	224.4825	175.2952	235.6508	186.4635	240.6668	191.4794
2	224.4658	190.4130	233.9492	199.8964	235.9687	201.9160
1	212.4413	193.5231	226.0241	207.1059	230.8088	211.8906
0	-86.6880	-90.4716	-69.6838	-73.4674	-66.8851	-70.6687
With dummy						
Variable	(m_0/p)		(m_1/p)		(m_2/p)	
4	138.0860	73.7641	145.1065	80.7846	144.2383	79.9164
3	134.7041	85.5167	143.2582	94.0709	144.5352	95.3478
2	140.0582	106.0055	149.2798	115.2270	147.8857	113.8329
1	133.4949	114.5767	148.6038	129.6856	150.3632	131.4450
0	-98.5297	-102.3133	-76.2147	-79.9983	-99.2036	-99.2036
Variable	m_0		m_1		m_2	
4	248.2055	148.8849	260.4145	161.0939	264.1727	164.8522
3	243.5898	167.9170	256.1861	180.5133	258.2599	182.5871
2	246.8292	194.8041	258.7372	206.7121	258.5171	206.4920
1	240.1091	211.7318	254.6936	226.3163	258.8156	230.4383
0	-75.4741	-80.2036	-56.4106	-61.1401	-54.6428	-59.3723

Full reports available in Appendix I and Appendix J.

The summary results of the Johansen Cointegration tests are displayed in Tables 4.12.1 to 4.12.3. Here, estimation results of real money demand with and without a dummy variable are presented. The estimations of normal money demand estimated from above ARDL and Phillip-Hansen tests demonstrate that variables do not perform well compared with the real money demand. Therefore, we will not display these result again. The full estimations report can be found in Appendix I and Appendix J.

Table 4.12.1 – Johansen Cointegration Tests and Results

Panel A: the results of the λ-max and trace tests					
Variables: m_0/p, y, r (without dummy)					
Null	Alternative	λ-max statistic	95% critical value	Trace statistic	95% critical value
$r = 0$	$r = 1$	30.3873	22.04	56.879	34.87
$r \leq 1$	$r \geq 2$	21.8519	15.87	26.4916	20.18
Panel B: estimate of cointegrating vector					
m_0 / p			Constant	y	r
1.000			-3.3368 (0.52177)	1.2174 (0.13766)	-0.14222 (1.7167)
Panel C: vector error correction model					
Dependent Variable			Δm_t	Δy_t	Δr_t
Error Correction Term			-0.32587 (-2.4752)*	0.26325 (3.0813)*	0.32097 (1.7167)
Variables: m_0/p, y, r, D (with dummy)					
Null	Alternative	λ-max statistic	95% critical value	Trace statistic	95% critical value
$r = 0$	$r = 1$	59.6442	28.27	88.2032	53.48
$r \leq 1$	$r \geq 2$	16.6782	22.04	28.5589	34.87
Panel B: estimate of cointegrating vector					
m_0		Constant	y	r	D
1.000		-2.4467 (0.43348)	1.1670 (0.19462)	0.082789 (0.17416)	0.78583 (0.48810)
Panel C: vector error correction model					
Dependent Variable		Δm_t	Δy_t	Δr_t	ΔD_t
Error –Term		-0.14331 (-8.1493)	-0.088440 (-5.7095)	0.050034 (1.5825)	-0.021083 (-0.85644)

In panel A: r = number of cointegrating vectors. In panel B: values in parenthesis are standard errors. In panel C: values in parenthesis are values of t-statistics. Full report available in Appendix I -1 and Appendix J-1.

Table 4.12.2 - Johansen Cointegration Tests and Results

Panel A: the results of the λ-max and trace tests					
Variables: $m_1/p, y, r$ (without dummy)					
Null	Alternative	λ-max statistic	95% critical value	Trace statistic	95% critical value
$r=0$	$r=1$	51.9206	22.04	62.3294	34.87
Panel B: estimate of cointegrating vector					
m_1/p			Constant	y	r
1.000			-0.84481	1.3852	-0.067778
			(0.29498)	(0.090749)	(0.16405)
Panel C: vector error correction model					
Dependent Variable			Δm_t	Δy_t	Δr_t
Error Correction Term			-0.16948	-0.10918	0.071350
			(-9.0325)*	(-6.0389)*	(1.9103)
Variables: $m_1/p, y, r, D$ (with dummy)					
Null	Alternative	λ-max statistic	95% critical value	Trace statistic	95% critical value
$r=0$	$r=1$	55.0317	28.27	77.2185	53.48
Panel B: estimate of cointegrating vector					
m_1		Constant	y	r	D
1.000		-0.68249	1.1434	-0.22557	0.49479
		(0.25121)	(0.12167)	(0.12119)	(0.27830)
Panel C: vector error correction model					
Dependent Variable		Δm_t	Δy_t	Δr_t	ΔD_t
Error –Term		-0.22475	-0.14229	0.073572	-0.036367
		(-9.1500)	(-5.9122)	(1.4723)	(-0.93902)

In panel A: r = number of cointegrating vectors. In panel B: values in parenthesis are standard errors. In panel C: values in parenthesis are values of t-statistics. Full report available in Appendix I -2 and Appendix J-2.

Table 4.12.3 - Johansen Cointegration Tests and Results

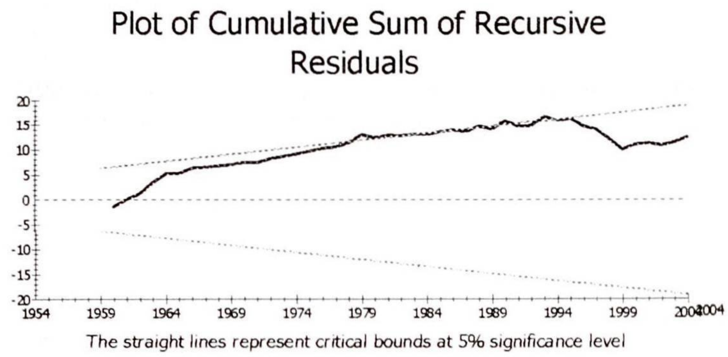
Panel A: the results of the λ-max and trace tests					
Variables: m_2/p, y, r (without dummy)					
Null	Alternative	λ-max statistic	95% critical value	Trace statistic	95% critical value
$r = 0$	$r = 1$	67.6409	22.04	75.3627	34.87
Panel B: estimate of cointegrating vector					
m_2 / p			Constant	y	r
1.000			-1.3721	1.8682	-0.38555
			(0.38790)	(0.18297)	(0.34232)
Panel C: vector error correction model					
Dependent Variable			Δm_t	Δy_t	Δr_t
Error Correction Term			-0.11100	-0.062427	0.034635
			(-11.4828)	(-6.1812)	(1.6287)
Variables: m_2/p, y, r, D (with dummy)					
Null	Alternative	λ-max statistic	95% critical value	Trace statistic	95% critical value
$r = 0$	$r = 1$	72.1914	28.27	94.0022	53.48
Panel B: estimate of cointegrating vector					
m_2		Constant	y	R	D
1.000		-1.0033	1.4471	0.19409	1.0160
		(0.45758)	(0.23880)	(0.28897)	(0.73756)
Panel C: vector error correction model					
Dependent Variable		Δm_t	Δy_t	Δr_t	ΔD_t
Error –Term		-0.10702	-0.059923	0.024979	-0.011305
		(-11.4736)	(-6.1314)	(1.2043)	(-0.70545)

In panel A: r = number of cointegrating vectors. In panel B: values in parenthesis are standard errors. In panel C: values in parenthesis are values of t-statistics. Full report available in Appendix I -3 and Appendix J-3.

From Tables 12.1, 12.2 and 12.3, it can be seen the subsequent implementation of the Johansen cointegration tests indicates that long-run relationships exists between the variables for real money demand functions in China.

Brown et al. (1975) stability tests are applied as well to see if the long-run relationship estimated from the Johansen cointegration is stable.

Figure 4.13 CUSUM and CUSUMSQ plots for Stability Test (for m_0/p without dummy variable)



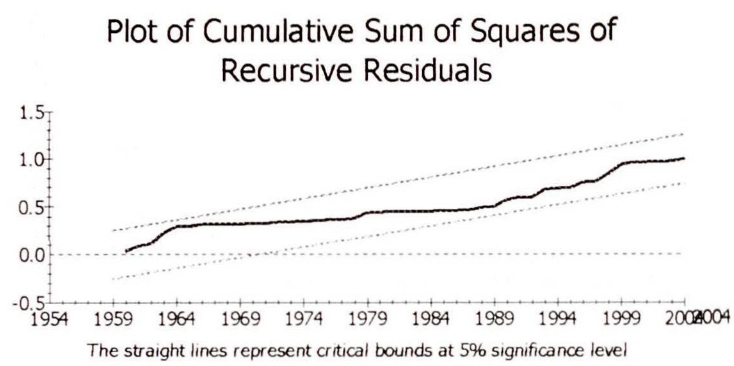
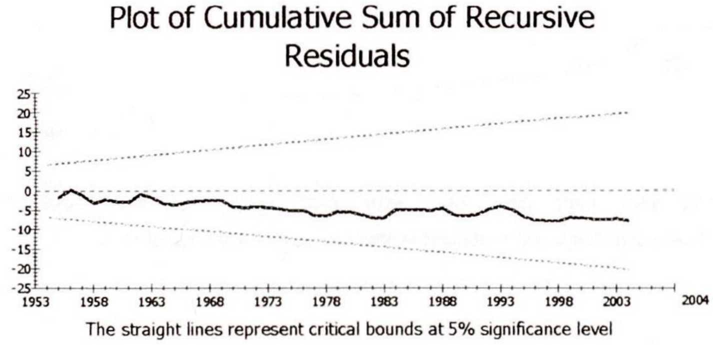


Figure 4.14 CUSUM and CUSUMSQ plots for Stability Test (for m_0/p with dummy variable)



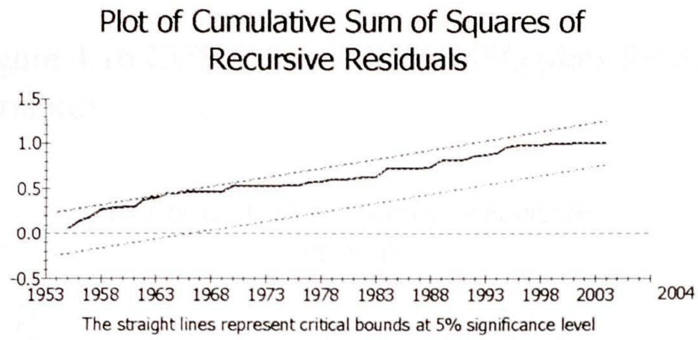
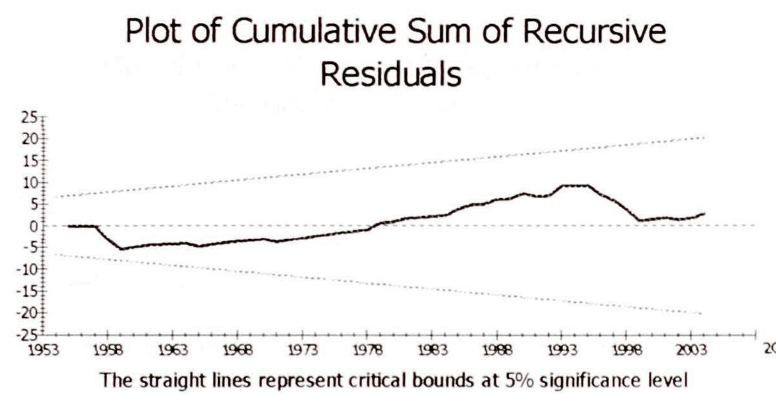


Figure 4.15 CUSUM and CUSUMSQ plots for Stability Test (for m_1/p without dummy variable)



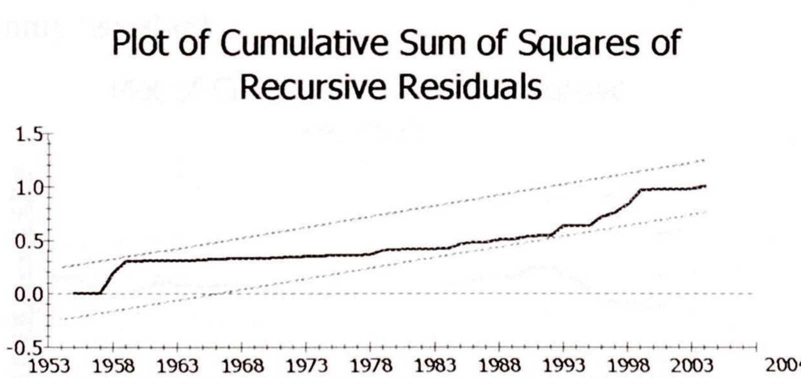
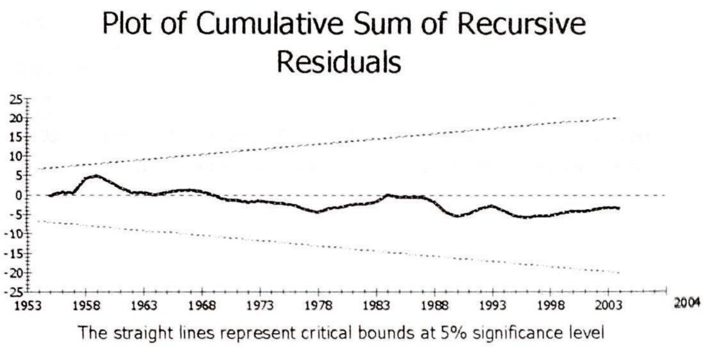


Figure 4.16 CUSUM and CUSUMSQ plots for Stability Test (for m_1 /p with dummy variable)



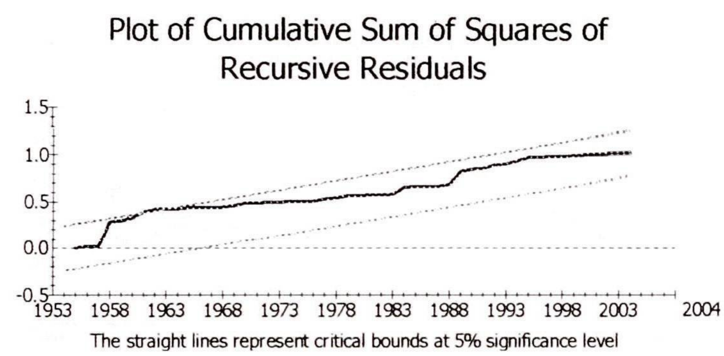
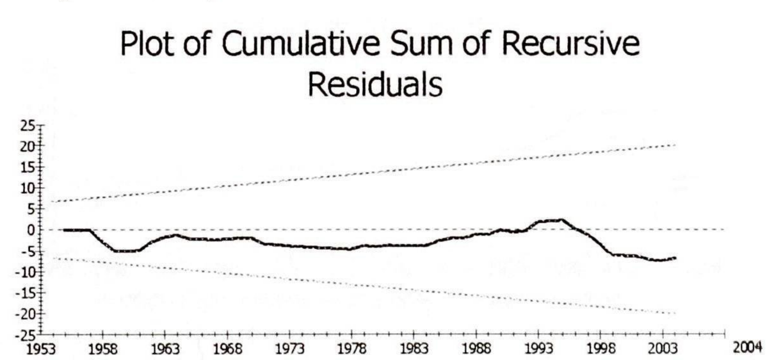


Figure 4.17 CUSUM and CUSUMSQ plots for Stability Test (for m_2 /p without dummy variable)



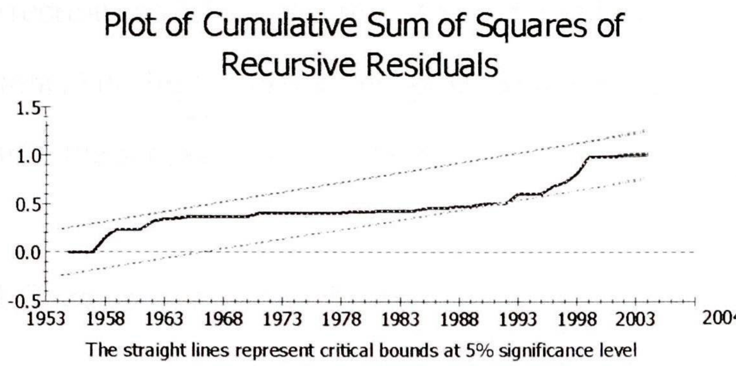
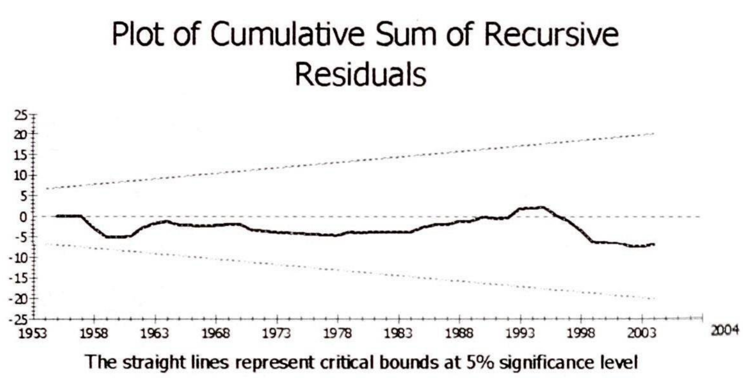
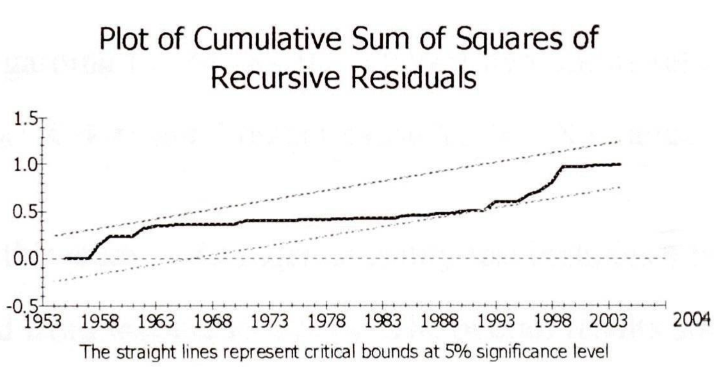


Figure 4.18 CUSUM and CUSUMSQ plots for Stability Test (for m_2 /p with dummy variable)





The plots of CUSUM and CUSUMSQ statistics of real money demand for m_1, m_0 and m_2 are well within the critical bounds, implying that the coefficients in the error correction model are stable. The first graph of real money demand for m_0 (without dummy) is slightly cross the upper bound marginally during the period 1979-1995 whilst the second graph is stable.

4.8 Granger Causality Tests

If co-integration is found to exist between the variables, then either uni-directional or bi-directional causality must exist in the variables. Granger's (1969) causality test is originally designed for stationary variables and has been extended into the co-integration models by Engle-Granger (1987) and Granger (1988). The Granger causality test between Y and X variable is based on the following regression:

$$X_t = \alpha_0 + \sum_{i=1}^{n} a_i X_{t-i} + \sum_{j=1}^{n} b_j Y_{t-j} + u_t \qquad (4.17)$$

$$Y_t = \beta_0 + \sum_{i=1}^{n} c_i Y_{t-i} + \sum_{j=1}^{n} d_j X_{t-j} + u_t \qquad (4.18)$$

Regarding Eq. (4.17) we set our hypothesis as

H_0: Y does not Granger cause X. H_1: Y Granger cause X.

Regarding Eq. (4.18), the relevant hypothesis set as:

H_0: X does not Granger cause Y. H_1: X Granger cause Y.

In this study, a Granger causality test includes a two-way test, from money to income, and from income to money. The overall results shown in Table 4.13 indicate that there is unidirectional causality runs from y to m_1/p and runs from y to m_1. For real and nominal money demand for m_0, there is bi-directional causality between currency in circulation and real income. For real and nominal money demand for m_2, there is no causation between the broad money and income as the null hypothesis cannot be rejected.

Table 4.13 –Granger Causality Tests

Sample: 1952 -2004 lags:2

Direction of causality		F-statistic	Prob.	Decision
$y \rightarrow m_0/p$	H_0: y does not Granger cause m_0/p	3.8715*	[0.028]	Reject H_0:
$m_0/p \rightarrow y$	H_0: m_0/p does not Granger cause y	7.6763*	[0.001]	Reject H_0:
$y \rightarrow m_1/p$	H_0: y does not Granger cause m_1/p	3.8478*	[0.028]	Reject H_0:
$m_1/p \rightarrow y$	H_0: m_1/p does not Granger cause y	1.0114	[0.372]	Do not reject H_0:
$y \rightarrow m_2/p$	H_0: y does not Granger cause m_2/p	2.2680	[0.115]	Do not reject H_0:
$m_2/p \rightarrow y$	H_0: m_2/p does not Granger cause y	2.0174	[0.145]	Do not reject H_0:
$y \rightarrow m_0$	H_0: y does not Granger cause m_0	4.6592*	[0.014]	Reject H_0:
$m_0 \rightarrow y$	H_0: m_0 does not Granger cause y	5.1448*	[0.010]	Reject H_0:
$y \rightarrow m_1$	H_0: y does not Granger cause m_1	4.3996*	[0.018]	Reject H_0:
$m_1 \rightarrow y$	H_0: m_1 does not Granger cause y	2.1173	[0.132]	Do not reject H_0:
$y \rightarrow m_2$	H_0: y does not Granger cause m_2	2.4415	[0.098]	Do not reject H_0:
$m_2 \rightarrow y$	H_0: m_2 does not Granger cause y	1.5958	[0.214]	Do not reject H_0:

Full results of Granger Causality Tests available in appendix K.

4.9 Chow Parameter Constancy Test

The Chow parameter constancy test is used to test whether the parameters being estimated are stable or not stable over the estimation period (Halicioglu, 2004). The recursive least squares enable to estimate a linear regression equation recursively, the statistics can be calculated for each recursion and its value can be plotted against time. This test plots the coefficients and standard errors of each of the variables, if the coefficients fall within the bands standard errors then the variable is considered stable over the period estimated. The full reports of Chow Parameter constancy test are available in the Appendix B. The coefficient of following each variable falls within the bands set by the variable standard errors, the variables could be considered stable over the period estimated.

For m_1

Figure 4.19 Chow test for y

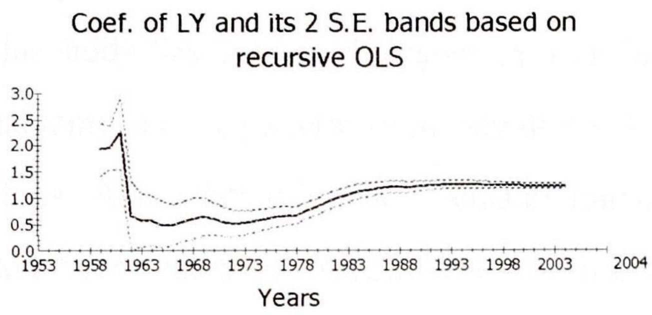


Figure 4.20 Chow test for r

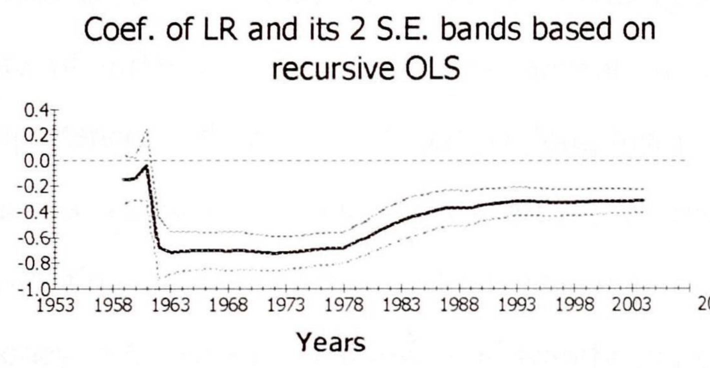
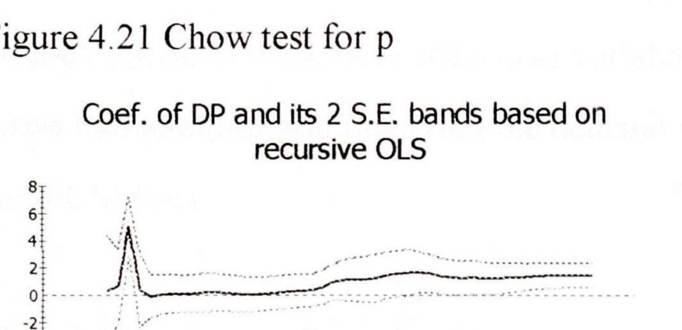


Figure 4.21 Chow test for p



4.10 Summary and Conclusions

This study has attempted to give an overview of the monetary sector of the Chinese economy and the patterns of money demand functions and their structural dynamics in China. A number of money demand functions for annual data between1952-2004 have been estimated. A summary of various estimations from different cointegration approach is shown in Table 4.14. In recent years, the performance of the Chinese authorities accelerated the reform of the banking system and the financial sector and has moved to a system of monetary control through indirect, market based instruments. The central bank PBC has more ability to forecast the quantity of money which consumers demanded while maintaining a certain level of national income and rate of inflation, hence, the development of money demand equation is of great importance. This study analyzed the long history of the Chinese economy to indicate various economic fluctuations. With the dramatic economic development and institutional changes resulting from economic reforms, it is likely that the demand for money in China also changed significantly and constructions of a dummy variable in the regression equations is necessary. The previous work by Yi (1993) and Qin (1994) added one intercept dummy to separate the estimated period into two - prior to and after economic reform and current study supports these findings further. This study extends previous work with additional variables and longer period by applying time-series methodology and involving the demand for money regressions for cointegration and ECM tests.

The stabilization policy should aim at those components of money which are cointegrated with all the explanatory variables. Table 4.14 provides a summary of various estimations and the estimation results from different cointegration analyses are consistent indicating that the empirical results are robust. A long-run stable money demand function exists in China. Some studies on developing countries indicated that the models on narrow money worked better. Through this whole study by using different methodologies, it is found that the coefficients estimated from data over different time periods, especially for real narrow money demand m_1, do not alter significantly. Therefore, the monetary policy should aim primarily at narrow money m_1. The stability implies that the demand for money is highly predictable.

Table 4.14 Summary of Results of Demand for Money Functions in China 1952-2004

Long-run without dummy												
	EGTS			Phillips-Hansen			Pesaran et al. (ARDL)			Johansen		
money	y	r	p	y	r	p	y	r	p	y	r	p
m_0/p	1.3827	0.092218		1.4155	0.15715		1.4834	0.11551		1.2174	-0.14222	
m_1/p	1.2721	-0.24046		1.2921	-0.20522		1.2935	-0.16860		1.3852	-0.067778	
m_2/p	1.5931	-0.10835		1.6213	-0.056971		1.7252	-0.19719		1.8682	-0.38555	
m_0	1.2140	0.041262	1.3569	1.1872	0.042096	1.4339	2.0563	0.37715	0.029947			
m_1	1.2232	-0.25522	1.1033	1.1909	-0.29069	1.1616	2.1036	0.56812	-0.11627			
m_2	1.2824	-0.20217	1.6582	1.2506	-0.22551	1.7204	3.2930	1.7447	-1.0954			
Long-run with dummy												
				Phillips-Hansen			Pesaran et al. (ARDL)			Johansen		
m_0/p				1.3341	0.085954		1.0934	-0.085041		1.1670	0.082789	
m_1/p				1.1800	-0.28290		1.0908	-0.28526		1.1424	-0.22557	
m_2/p				1.6208	-0.008865		1.3987	0.056472		0.52064	-0.12738	
m_0				0.98385	-0.060892	1.5409	1.0595	-0.045966	1.0841			
m_1				0.97717	-0.39246	1.2963	1.1315	-0.13404	1.0068			
m_2				1.0646	-0.31585	1.8310	1.5630	0.38231	0.94568			

Table 4.14 (Continued)

	Short-run without dummy									
	EGTS			Pesaran et al. (ARDL)			Johansen			
Money	y	r	p	y	r	p	y	r	p	
m_0/p	0.04653	0.10629		0.21486	0.012491		0.26325	0.32097		
m_1/p	0.56971	-0.16332		0.42781	-0.063872		-0.10918	0.071350		
m_2/p	0.70250	-0.12442		0.58952	-0.11060		-0.062427	0.034635		
m_0	0.092486	0.12953	0.16743	0.15979	-0.025701		0.041777	1.0391	0.20825	
m_1	0.59786	-0.16353	1.1323	0.27300	-0.10307	0.0062989	-0.072375	1.1102	0.50810	
m_2	0.55096	0.55096	0.88596	0.21853	-0.038540	-0.072687	0.047727	-0.17472	0.029128	
	Short-run with dummy									
				Pesaran et al. (ARDL)			Johansen			
m_0/p				-0.32398	0.092967		-0.088440	0.050034		
m_1/p				0.35769	-0.21763		-0.14229	0.073572		
m_2/p				0.47571	-0.17743		-0.059923	0.024979		
m_0				0.16857	-0.044762	1.2288	0.034703	1.0889	0.25301	
m_1				0.33950	-0.054325	0.33812	-0.11722	1.0979	0.79475	
m_2				0.22823	-0.079630	0.13809	0.055714	-0.020232	0.034156	

Table 4.14 (Continued)

Stability tests (From ARDL)						
With dummy	m_0 / p	m_1 / p	m_2 / p	m_0	m_1	m_2
CUSUM	Yes	Yes	No.	Yes	Yes	Slightly Cross upper band margin during 1990-1995
CUSUMSQ	Yes	Yes	Cross upper band during 1990-1995	Yes	Yes	Slightly Cross upper band margin during 1990-1995
Without dummy	m_0 / p	m_1 / p	m_2 / p	m_0	m_1	m_2
CUSUM	Yes	Yes	Yes	Yes	Yes	Yes
CUSUMSQ	Yes	Yes	Yes	Yes	Yes	Yes
ECM						
	m_0 / p	m_1 / p	m_2 / p	m_0	m_1	m_2
Without dummy	Yes	Yes	Yes	Yes	Yes	Yes
With dummy	Yes	Yes	Yes	Yes	Yes	Yes
Hypothesis Testing of Income Coefficients Via Wald Test						
	m_0 / p	m_1 / p	m_2 / p	m_0	m_1	m_2
Without dummy	17.8605[.000]	85.7400[.000]	78.6264[.000]	2.7221 [0.099]	2.9056 [0.088]	1.2103 [0.271]
With dummy	0.0025567[0.96]	3.7050 [0.051]	5.9886 [0.014]	1.6390 [0.20]	1.4137 [0.234]	2.3828 [0.123]

Chapter 5 Models of Demand for Money With Other Influences

5.1 Introduction

In the preceding chapter, various money demand functions have been estimated for the period 1952-2004. It is found that real money demand functions has better performance than the nominal money demand functions and the real money demand for m_1 presents more satisfactory coefficients than the other two in terms of econometric diagnostics. The long-run and short-run income elasticity of money demand also confirms the positive relation between money demand and economic growth. The appropriate dummy variable evaluated the effects of economic reform in China on the demand for money.

In this chapter, a few additional variables which may influence the money demand in China will be explored. As analyzed earlier, the independent variables in the demand for money function could normally fall into three groups –scale variables, opportunity cost variables and other variables. Some of the previous studies have considered some of these 'other variables', for example, real wage rate and the riskiness of bonds have been used in a number of studies. At least two studies into five difference economies by Bordo and Jonung (1981) have tried to investigate the effects of long-run institutional changes on the demand for money. They used such variables as the proportion of the labour force employed outside of agriculture, the ratio of population to bank offices, the ratio of currency to the total money stock and the ratio of non-bank financial assets to total financial assets to measure the degree of the monetization and financial development of the economies under study (Laidler, 1993). Yi (1993) introduced the ratio of urban population to total population as a proxy of monetization process in China; another closer proxy of the monetization process is proposed by Qin (1994) who used the average of two ratios: the price ratio of agricultural to industrial output deflators and the output ratio of the non-state-owned industry to the whole industry. Additionally Qin (1994) introduced the ratio of the total savings and loans to capture the special features of a centrally planned economy.

This chapter is divided into eleven sections. The second, third and fourth sections will explain why consideration is given to the influences of other variables in the specific context. The fifth section will outline the methodology and equations. The sixth to tenth section will outline the empirical results for each technique used. The last section will provide a conclusion and summary.

5.2 Money demand with real wages

A number of empirical analyses in the past used real wage rates to investigate the relationship between wages and money demand in Western countries. The evidence showed that it is unwise to neglect the role of real wage influence, as it plays an important role in both transactions and precautionary theories of the demand for money. The wage rate has been proved to have a positive effect on the demand for money regardless of precisely which other variables are included in the function. This idea was first suggested by Dutton and Gramm (1973). They found that the predictions of wage rate influences on money demand models were important. The argument behind the wage rate hypothesis is that an increase in the wage rate leads to an increase not only in income and consumption, but also in turn tends to increase money demand (Kevin, 1990). In most societies, the ultimate purpose of economic growth is to raise the consumption and welfare of the people. Chinese economic growth led to a dramatic rise in the standard of living of Chinese people after economic reform and this raises the question of whether the wage rate influences money demand in China. As data on official real wage rates are not available, the total wage index deflated by inflation will be used as an additional variable in the same real demand for money function estimated in chapter 4.

5.3 Monetization process

In line with other LDCs, The Chinese case should also be considered in the light of the rise in the proportion of monetized transactions (Ghatak, 1995). Chinese economic reform caused monetization after 1978 due to the increase of transaction demands of households and firms and the introduction of a responsibility system in the rural areas leading millions of farmers entering the market place. Through numerous township and village enterprises which emerged during reform, cash became one of the main mediums of exchange for these new institutions. These were usually outside the Central Plan and had autonomous management powers. Another reasons causing monetization was the rapid development of self-employed and private businesses as well as the swift increase in the free market. As a result of the market-oriented reforms in recent years, the Chinese people are now aspiring to own property, notably houses, durable consumer commodities and eventually automobiles. Banks and non-bank financial institutions have introduced various savings instruments since the reform, such as stock, and bonds. Yi (1994) indicated that reform in the housing sector and increasing the size of the stock and bond markets will certainly have monetization consequences. In the recent years, the monetization process has been playing an important role in determining the money demand in China; therefore, it is important to consider the effects that the monetization process variable will have on the models. The ratio of urbanization will be used in our model to account for the process of monetization.

5.4 Money demand and saving effects

Why consider savings effects on money demand function? Theoretically, savings are defined as deferred consumption of an economy or an economic agent. Savings behaviour is a crucial element of the process of economic growth, as they are a part of disposable income, which is not expended in present consumption but 'stored' for future expenditure (Fry, 1995a). There have been a number of studies on how financial development affects the economic growth and overall saving ratio in LDCs. During the period of 1985-2004 in China, the average GDP growth in China was the result of capital accumulation, supported by an extraordinarily high savings rate that has come to depend increasingly on China's households. Table 5.1 indicates that there has been a significant change in the saving level since 1978 and private household savings have now become the main source of savings (Shang, 1998). There are many reasons for the significant increase in savings. For example, savings for self-finance investment purpose induced some households to establish their own commercial enterprises; a trend for many households to send their children abroad for education; uncertainty about future income; a new attitude towards wealth promotes savings as people are holding money in order to expect a higher return in future, etc. The majority of households expect to save for these purposes (Wei, 1999). The following Table shows the dramatic increase of savings level after economic reform in 1978. Private household savings level increase from 5.81% in 1978 to 87.58% in 2004.

Table 5.1 China's Saving Level in 1952-2004 (billion yuan)

Year	S_t	S_h	GDP	S_t/GDP (%)	S_h /GDP (%)
1952	9.33	0.86	67.9	13.74	1.27
1960	45.98	6.63	145.7	31.56	4.55
1966	55.36	7.23	186.8	29.64	3.87
1973	86.5	12.12	272.1	31.79	4.45
1978	113.4	21.06	362.4	31.29	5.81
1985	426.49	162.26	896.4	47.58	18.10
1991	1486.41	924.16	2161.8	68.76	42.75
1996	6857.12	3852.08	6788.5	101.01	56.74
2000	11607.09	6433.24	8940.4	129.83	71.96
2004	24142.43	11955.54	13651.5	176.85	87.58

Notes: S_t: total deposits in financial institutions; S_h: total deposits of private households (urban and rural residents), S_t/GDP: saving level., S_h/GDP: private saving level.. Source: Almanac of China's Banking and Finance various issues

Previous study by Klovland (1983) investigated the relationship of the ratio of the saving deposit to currency on the money demand function in Norway. The study of the short-run demand for money indicates that the ratio of deposit to currency may influenced by the effect of the demand for money and increased riskness of bank deposit. In China, the ratio of total deposits to currency in circulation was usually used to indicate whether there was too much cash in circulation and this ratio was pretty stable before economic reform. Present study would like to employ the ratio of total deposits to currency *DCR*, into the money demand function, which is correlated with cash income, and therefore, allow planners to control money incomes and the money supply. The ratio of total deposit to GDP, *RDG* will be also used as a measure of saving level to check its influence on demand for money. The prediction of the hypothesis is that the increase of saving level will lead to increase in money demand.

5.5 Methodology and Equations

In this section, the real money demand functions with the additional variables will be estimated.

Following common practice, the money demand function could be estimated in the log linear form by adding both total wage index and percentage of urbanization as follows:

$$(m/p)_t = a + by_t + cr_t + dw_t + eROP_t + u_t \tag{5.1}$$

Where m/p is the real money demand, y is the real income, r is the interest rate, w is the real wage index. ROP is the ratio of urban population to total population used a proxy for the monetization process.

Excluding a variable each time in searching for the equilibrium relationship we get:

$$(m/p)_t = a + by_t + cr_t + dw_t + u_t \tag{5.2}$$

$$(m/p)_t = a + by_t + cr_t + dROP_t + u_t \tag{5.3}$$

Considering the influences of the ratio of total deposits to currency on money demand function we arrive at following:

$$(m/p)_t = a + by_t + cr_t + dDCR_t + u_t \tag{5.4}$$

Where, DCR is the ratio of total deposits to currency.

The ratio of total deposit to GDP will be used as a measure of saving level to check its influence on demand for money as follows:

$$(m/p)_t = a + by_t + cr_t + dRDG_t + u_t \tag{5.5}$$

Where, RDG is the ratio of total deposit to GDP.

The intercept dummy variable D will be added to each of the above equations to highlight the influences of economic reform. The estimated period will be in two: $D = 0$ for the period 1952-1978, and $D = 1$ for the period 1979-2004.

The methodologies of chapter 4 will be used. Firstly, to check all time series variables included in the study for unit roots, the three procedures suggested by Autocorrelation Function Approach, Augmented Dickey-Fuller test and Phillip-Perron test will be employed again. Secondly, to check if all the non-stationary variables included in a regression are cointegrated, Pesaran *et al.* (2001), Phillips-Hansen Cointegration Approach, and Johansen Multivariate Cointegration techniques will be employed. Third, the ECM will be checked to see if it would be appropriate. Brown et al stability test will be applied to see if the long-run relationship estimated is stable. Wald test for homogeneity will be applied. In addition, the Chow parameter constancy test is used to test whether the parameters being estimated are stable or not over the estimation period. As EGTS methods are no good to show the cointegration relationship between the variables, we will omit it in this chapter.

5.6 Tests for Stationarity

Three Stationarity tests are performed. The estimations results are reported in Table 5.2.1. Full results provided in Appendix M.

Table 5.2.1 indicates that the autocorrelation coefficients are all around zero. The ADF and PP tests demonstrate that all additional variables of real wage index w, ratio of ROP, ratio of DCR, ratio of RDG reject the hypothesis of unit roots in their first difference meaning that they are integrated of order 1 at the 5% significance level.

Table 5.2.1 -Unit Root Tests

Autocorrelation Function: Mean Value

	Level	1^{st} Difference
w	-2.5311	0.077483*
ROP	-1.5489	0.024092*
DCR	1.6126	0.023068*
RDG	-0.82584	0.048790*

* Stationary series.

ADF test statistic

Variable	Levels	*k* lag	1^{st} Differences	*k* lag
w	-2.5826	1	-6.9092*	1
ROP	-1.3248	1	-4.8397*	1
DCR	-0.22229	3	-6.5242*	2
RDG	-2.0346	1	-5.2142*	1

*Rejection of unit root hypothesis, according to Mackinnon's (1991) critical value at 5%., selection based on AIC and SBC criteria, to k lags.

Phillips-Peron test statistic

Variable	Levels	t- lag	1^{st} Differences	t-lag
w	-2.5637	5	-7.7266*	5
ROP	-1.1721	5	-5.5463*	5
DCR	-1.8499	5	-7.4220*	5
RDG	-2.2040	5	-7.0713*	5

*Rejection of unit root hypothesis, according to Mackinnon's (1991) critical value at 5%. 't-lag' is the truncation lag level. ACF tests reported in Appendix M-1, ADF tests reported in Appendix M-2 and PP tests reported in Appendix M-3.

Table 5.2.2 summarizes that the order of integration for each variable under each of above three tests and all variables are accepted as stationary in the first difference.

Table 5.2.2 – Summary of Results of Unit Root Tests

Variable	Correlogram	ADF	Phillips-Perron
w	I(1)	I(1)	I(1)
ROP	I(1)	I(1)	I(1)
DCR	I(1)	I(1)	I(1)
RDG	I(1)	I(1)	I(1)

5.7 Pesaran *et al*. (2001) ARDL Cointegration Procedure

With complementing ARDL method, as explained in chapter 4, first, the order of lags on the first differenced variables is obtained from VAR by means of AIC and SBC. F-test is performed and reported in Table 5.3. The results are considered preliminary since the choice of lag length was arbitrary.

Table 5.3 F-statistics for Testing the Existence of a Long-run Money Demand

Order of lag	F-statistics (Without Dummy)				
	Eq(5.1)	Eq(5.2)	Eq(5.3)	Eq(5.4)	Eq(5.5)
1	2.0460	1.6334	2.7259	1.6049	1.2437
2	1.1418	2.3206	1.4973	1.8823	2.1880
3	2.3037	2.7177	1.9799	2.1756	2.4572
	F-statistics (With Dummy)				
1	3.6916	1.8632	3.1745	1.7877	1.2836
2	1.0440	1.5807	1.3491	1.6760	2.2531
3	2.2041	2.5592	1.7744	2.0241	2.7277

Notes: The relevant critical value bounds are obtained from Table C1.iii (with an unrestricted intercept and no trend, with three regressors) in Pesaran *et al.*(2001). They are 2.72-3.77 at 90%, and 3.23-4.35 at 95%. * denotes that the F-statistic falls above 90% upper bound and ** denotes above the 95% upper bound. Full results available in Appendix O.

In estimating the money demand function by ARDL method when the lag included, the initial lag level selected as two in order to minimize the loss of degree of freedom. For testing the long-run money demand function, the initial regressions of Eq. (5.1) to Eq. (5.5) are used. The dummy variable D is also added in each equation to make comparison with and without dummy to highlight the influences of the economic reform. The second stage retains the lagged level of variables and estimate above equations using an appropriate lag selection criterion such as the adjusted R^2, AIC, SBC and HQC. The long-run coefficient estimates are reported in following Tables 5.4.1 to 5.4.5. Full report can be found in Appendix -O.

Table 5.4.1 – ARDL Estimations- Eq.(5.1)

Panel A: the long-run results

	Dependent variable m_1/p				
	(with dummy)			(without dummy)	
	$\overline{R}^2$ (2,2,2,22,0)	AIC (2,0,2,2,2,0)	SBC/HQC (2,0,0,1,2,0)	AIC/ $\overline{R}^2$/HQC (2,2,2,1,0)	SBC (1,0,0,0,0)
Constant	1.6568 (6.0701)	1.7487 (6.9735)	1.5287 (5.1509)	1.0689 (1.7726)	0.69985 (1.0920)
y	0.65048 (9.4898)	0.62983 (10.0769)	0.67929 (9.4105)	0.88793 (6.1574)	1.0083 (7.1302)
r	-0.22760 (-10.9342)	-0.22856 (-11.0893)	-0.22944 (-9.5183)	-0.19411 (-4.5836)	-0.18238 (-3.7441)
w	0.40715 (4.8235)	0.42194 (5.1697)	0.34542 (3.8947)	0.23954 (1.3741)	0.11516 (0.72426)
ROP	0.62248 (4.5885)	0.64095 (4.7827)	0.66746 (4.3035)	0.65743 (2.3558)	0.68586 (2.2250)
D	0.22535 (5.1644)	0.23201 (5.4790)	0.27811 (5.9329)		
Panel B: the short-run diagnostic tests					
R^2	0.99904	0.99898	0.99880	0.99831	0.99762
DWh	2.1698	2.0669	1.9152	1.9304	1.5608
$\chi^2_{SC}(1)$	1.9399	0.25355	0.17340	0.95026	2.2843
$\chi^2_{FC}(1)$	0.75579	0.045192	0.33231	10.3335	4.7186
$\chi^2_{N}(2)$	2.4208	2.3261	4.0695	1.3622	4.0156
$\chi^2_{H}(1)$	0.89794	1.0138	1.3317	0.95234	0.77138

Maximum lag set to 1. The t-ratios in parenthesis in Panel A. χ^2_{SC}, χ^2_{FC}, χ^2_{N}, χ^2_{H} are lagrange multiplier statistics for, respectively, tests of residual correlation, functional form misspecification, non-normal erros and heteroskedastcity. The statistics are distributed as Chi-squared variates within degrees of freedom in parenthesis in panel B.
Full results available in Appendix O-1 and Appendix O-2.

Table 5.4.2 – ARDL Estimations- Eq.(5.2)

Panel A: the long-run results

Dependent variable m_1/p

	(with dummy)				(without dummy)		
	$\overline{R}^2$ (2,2,2,2,0)	AIC (2,2,0,2,0)	SBC (1,0,0,1,0)	HQC (2,2,0,1,0)	AIC/$\overline{R}^2$ (2,2,2,1)	HQC (2,2,01)	SBC (1,0,0,0)
Constant	0.99645 (2.1337)	1.0418 (2.3743)	0.85346 (1.9200)	0.79469 (1.7216)	0.25984 (0.34879)	0.29105 (0.41678)	-0.24146 (-0.37484)
y	0.67402 (5.5096)	0.65896 (5.6629)	0.72102 (6.1317)	0.72207 (5.8752)	0.95926 (4.9876)	0.94804 (5.2760)	1.1160 (6.6620)
r	-0.23774 (-6.4371)	-0.22822 (-6.5514)	-0.24885 (-6.4862)	-0.23996 (-6.3125)	-0.19112 (-3.4674)	-0.17415 (-3.4195)	-0.19161 (-3.2330)
w	0.53302 (4.1110)	0.54872 (4.5408)	0.48049 (3.9103)	0.47567 (3.7735)	0.35088 (1.7108)	0.36546 (1.9022)	0.19711 (1.1072)
D	0.27295 (3.4772)	0.27719 (4.1589)	0.29554 (3.9438)	0.28879 (3.8873)			
Panel B: the short-run diagnostic tests							
R^2	0.99858	0.99850	0.99804	0.99843	0.99810	0.99794	0.99738
DWh	1.9487	1.8910	1.4663	1.9251	1.9350	1.9077	1.5187
$\chi^2_{SC}(1)$	0.14546	.5921	4.6057	0.27693	0.23370	0.51196	3.1962
$\chi^2_{FC}(1)$	4.8113	4.3482	3.0827	2.4355	0.030990	0.048646	0.0028202
$\chi^2_{N}(2)$	0.51600	0.51377	3.0920	0.83572	0.97610	1.2475	5.3727
$\chi^2_{H}(1)$	2.0090	2.3786	1.0744	2.7751	3.6121	3.7878	1.3402

Maximum lag set to 1. The t-ratios in parenthesis in Panel A. χ^2_{SC}, χ^2_{FC}, χ^2_{N}, χ^2_{H} are lagrange multiplier statistics for, respectively, tests of residual correlation, functional form misspecification, non-normal errors and heteroskedastcity. The statistics are distributed as Chi-squared variates within degrees of freedom in parenthesis in panel B.
Full results available in Appendix O-3 and Appendix O-4.

Table 5.4.3 – ARDL Estimations- Eq.(5.3)

Panel A: the long-run results

	Dependent variable m_1/p				
	(with dummy)		(without dummy)		
	$\overline{R}^2$ (2,2,2,2,2)	AIC/SBC/HQC (2,0,0,2,0)	AIC/ $\overline{R}^2$ (2,2,2,0)	HQC (2,2,0,0)	SBC (1,0,0,0,0)
Constant	0.73450 (1.9575)	0.83450 (2.3868)	0.57735 (0.98146)	0.36531 (0.62014)	0.43079 (0.77924)
y	0.92424 (15.2019)	0.92146 (16.4342)	1.0619 (12.3467)	1.0907 (12.6206)	1.0954 (13.4546)
r	-0.26098 (-6.8842)	-0.23530 (-6.8117)	-0.19505 (-3.6391)	-0.17621 (-3.3878)	-0.18270 (-3.5735)
ROP	0.88504 (4.3344)	0.95824 (5.0811)	0.85188 (2.7339)	0.75003 (2.3885)	0.76244 (2.5633)
D	0.31241 (3.6947)	0.28546 (4.2315)			

Panel B: the short-run diagnostic tests

R^2	0.99874	0.99848	0.99814	0.99978	0.99759
DWh	2.0060	1.7876	1.9456	1.8729	1.4869
$\chi^2_{SC}(1)$	0.056761	1.0032	0.029163	0.77011	2.9802
$\chi^2_{FC}(1)$	10.6379	4.5174	11.3932	8.7470	5.1579
$\chi^2_{N}(2)$	5.1497	10.1700	2.3161	1.9585	4.9715
$\chi^2_{H}(1)$	0.041394	0.40393	0.74565	0.96487	0.41467

Maximum lag set to 1. The t-ratios in parenthesis in Panel A. χ^2_{SC}, χ^2_{FC}, χ^2_{N}, χ^2_{H} are lagrange multiplier statistics for, respectively, tests of residual correlation, functional form misspecification, non-normal errors and heteroskedastcity. The statistics are distributed as Chi-squared variates within degrees of freedom in parenthesis in panel B.
Full results available in Appendix O-5 and Appendix O-6.

Table 5.4.4 – ARDL Estimations- Eq.(5.4)

Panel A: the long-run results

	Dependent variable m_1/p						
	(with dummy)				(without dummy)		
	$\overline{R}^2$ (2,2,2,1,2)	AIC (2,2,1,0,0)	SBC (1,0,1,0,0)	HQC (1,1,1,0,0)	AIC/ $\overline{R}^2$ (2,2,1,0)	HQC (1,1,1,0)	SBC (1,0,1,0)
Constant	-1.2413 (-1.9388)	-0.66107 (-1.3043)	-0.59431 (-1.2679)	-0.42860 (-0.75414)	-0.35621 (-0.57858)	-0.059261 (-0.086092)	-0.31951 (-0.59954)
y	1.0701 (10.4606)	1.1368 (12.6463)	1.1519 (13.7547)	1.1300 (11.1956)	1.3381 (23.3581)	1.3597 (20.9178)	1.3524 (25.8174)
r	-0.2119 (-1.6386)	-0.29394 (-2.7657)	-0.30159 (-3.0857)	-0.33858 (-2.8628)	-0.28446 (-2.2265)	-0.33131 (-2.3524)	-0.28664 (-2.5514)
DCR	2.1141 (-0.64619)	-0.10062 (-0.39660)	-0.11085 (-0.46537)	-0.17684 (-0.62107)	-0.33127 (-1.1047)	-0.44404 (-1.3280)	-0.32243 (-1.2349)
D	0.45170 (2.5593)	0.39721 (2.4158)	0.39320 (2.5950)	0.44726 (2.3886)			
Panel B: the short-run diagnostic tests							
R^2	0.99843	0.99823	0.99791	0.99804	0.99793	0.99793	0.99755
DWh	1.9007	1.8942	1.4355	1.5064	1.8752	1.4693	1.3768
$\chi^2_{SC}(1)$	0.62336	0.4912	4.2699	3.7879	0.94305	4.4474	5.3036
$\chi^2_{FC}(1)$	0.039726	0.66005	0.80150	2.1858	0.021463	0.66251	0.048585
$\chi^2_{N}(2)$	2.3447	2.3241	7.3157	3.4126	1.4094	0.48349	2.1014
$\chi^2_{H}(1)$	0.17781	0.7619	0.099674	0.31979	2.3824	1.7064	0.95283

Maximum lag set to 1. The t-ratios in parenthesis in Panel A. χ^2_{SC}, χ^2_{FC}, χ^2_{N}, χ^2_{H} are lagrange multiplier statistics for, respectively, tests of residual correlation, functional form misspecification, non-normal errors and heteroskedastcity. The statistics are distributed as Chi-squared variates within degrees of freedom in parenthesis in panel B. Full results available in Appendix O-7 and Appendix O-8.

Table 5.4.5 – ARDL Estimations- Eq.(5.5)

Panel A: the long-run results

	Dependent variable m_1/p						
	(with dummy)			(without dummy)			
	HQC (2,2,0,0,0)	AIC/ $\bar{R}^2$ (2,2,2,0,2)	SBC (1,1,0,0,0)	$\bar{R}^2$ (2,2,2,2)	AIC (2,2,2,0)	HQC (2,1,0,0)	SBC (1,1,0,0)
Constant	-0.45899 (-2.8811)	-0.40766 (-2.7349)	-0.36273 (-2.1987)	-0.57045 (-2.5504)	-0.50297 (-2.6403)	-0.48079 (-2.2188)	-0.48376 (-2.3152)
y	0.93119 (11.6885)	0.91630 (12.5450)	0.90283 (11.1410)	1.0736 (10.8950)	1.0404 (12.5910)	1.0265 (10.9048)	1.0540 (11.8568)
r	-0.16736 (-3.2702)	-0.19358 (-3.7300)	-0.17266 (-3.1464)	-0.14604 (-2.0711)	-0.11548 (-1.9877)	-0.089074 (-1.2465)	-0.098573 (-1.4371)
RDG	0.41260 (3.5105)	0.42830 (3.7264)	0.45180 (3.7469)	0.37230 (2.0769)	0.45325 (3.1078)	0.47998 (2.8477)	0.44312 (2.7648)
D	0.31545 (3.5347)	0.31877 (3.1906)	0.33705 (3.5245)				
Panel B: the short-run diagnostic tests							
R^2	0.99847	0.99870	0.99825	0.99830	0.99820	0.99795	0.99779
DWh	1.9228	2.1055	1.4802	2.0755	1.9933	1.8191	1.4178
$\chi^2_{SC}(1)$	0.026712	1.1615	3.3793	0.98282	0.14129	0.93562	4.6864
$\chi^2_{FC}(1)$	3.6043	7.3496	0.98506	8.0838	10.1985	4.4526	3.2272
$\chi^2_N(2)$	2.6554	0.9218	4.6924	1.8413	1.9825	4.3220	2.2041
$\chi^2_H(1)$	0.33535	0.058904	0.29249	0.44560	0.30044	0.73620	1.1348

Maximum lag set to 1. The t-ratios in parenthesis in Panel A. χ^2_{SC}, χ^2_{FC}, χ^2_N, χ^2_H are lagrange multiplier statistics for, respectively, tests of residual correlation, functional form misspecification, non-normal errors and heteroskedastcity. The statistics are distributed as Chi-squared variates within degrees of freedom in parenthesis in panel B.
Full results available in Appendix O-9 and Appendix O-10.

Tables 5.4.1 to 5.4.5 demonstrate that all the diagnostic tests have good result. The long-run real money demand function of narrow money $m_1$with additional variable of real wage index w, the ratio of ROP, ratio of RDG all have significant positive influences on real money demand function. The ratio of DCR has a negative influence. The equations with additional dummy variable for the regressions with ratio of RDG perform better than without dummy. The income elasticity is more close to unity for Eq. (5.1) when without adding dummy variable.

The Hypothesis testing of income coefficient via Wald test is performed. The estimation results are displayed in Table 5.5 which shows that majority equations do not reject the null hypothesis of the income coefficient being equal to one. Full test results can be found in appendix P.

Table 5.5 –Hypothesis Testing of Income Coefficients Via Wald Test

	Dependent variable	With dummy	Without dummy
Eq.(5.1)	m_1 / p	19.7393* [.000]	0.0034425 [0.953]
Eq.(5.2)	m_1 / p	5.6290*[0.018]	0.47915 [0.489]
Eq.(5.3)	m_1 / p	1.9620 [0.161]	1.3725 [0.241]
Eq.(5.4)	m_1 / p	3.2896* [0.070]	45.2608* [000]
Eq.(5.5)	m_1 / p	1.4378 [0.230]	0.36958 [0.543]

The values within square brackets represent the probabilities of rejecting the null hypotheses and the values in the front of them denote the test statistics. * indicate the significances of the statistics. Full results available in Appendix P.

The estimates of the error correction representation selected by R^2, AIC, SBC and HQC are presented in Tables 5.6.1 to 5.6.5 and reported in full in appendix O. The error correction coefficients carry the expected negative sign and are significant in all cases. The adjusted R^2 suggests that the error correction models fit the data reasonably well.

Table 5.6.1 – Error Correction Representation of the ARDL Model- Eq.(5.1)

Short-run dependent variable $\Delta\ (m_1/p)$				
	With dummy		Without dummy	
	Eq.(1)	Eq.(2)	Eq.(3)	Eq.(4)
Regressors	AIC/ $\overline{R}^2$ (2,0,2,2,2,0)	SBC/ HQC (2,0,0,1,2,0)	AIC/ $\overline{R}^2$ HQC (2,2,2,1,0)	SBC (1,0,0,0,0)
Δm_{t-1}	0.42124 (3.8159)	0.30716 (2.9688)	0.38279 (2.8760)	
Δy_t	0.53143 (7.3279)	0.48772 (7.6877)	0.70869 (5.2809)	0.42525 (5.9197)
Δy_{t-1}			-0.33332 (-2.1268)	
Δr_t	-0.17110 (-3.2322)	-0.16473 (-6.4172)	-0.16646 (-2.6596)	-0.076919 (-3.1098)
Δr_{t-1}			0.15974 (2.1485)	
Δw_t	0.10074 (1.7415)	0.10108 (1.8151)	-0.019582 (-0.28427)	0.048570 (0.69016)
Δw_{t-1}	-0.076632 (-1.5138)			
ΔROP_t	-0.201123 (-0.095800)	-0.16174 (-0.75493)	0.030570 (2.2203)	0.28926 (2.1016)
ΔROP_{t-1}	-0.78402 (-3.9746)	-0.75063 (-3.8675)		
ΔD_t	0.19576 (5.0613)	0.19967 (5.1141)		
Constant	1.4755 (4.3566)	1.0976 (3.9210)	0.49706 (1.5001)	0.29516 (1.0233)
e_{t-1}	-0.84378 (-7.2752)	-0.71797 (-8.5224)	-0.46500 (-4.2221)	-0.42175 (-5.9250)
$\overline{R}^2$	0.70795	0.68392	0.54317	0.44025
F-Statistics	13.4206	14.7732	8.8061	8.8651
DW	2.0669	1.9152	1.9304	1.5608

Long-run equations

Eq.(1)	$ecm = m_1/p$ -0.62983*y +0.22856*r- 0.42194*w-0.64085*ROP- 0.23201*D -1.7487
Eq.(2)	$ecm = m_1/p$ -0.679295*y +0.22944*r- 0.34542*w-0.66746*ROP- 0.27811 *D -1.5287
Eq.(3)	$ecm = m_1/p$ -0.88793*y +0.19411*r -0.23954 *w-0.65743*ROP- 1.0689
Eq.(4)	$ecm = m_1/p$ -1.0083*y +0.18238*r -0.11516 *w-0.68586*ROP- 0.69985

The t-ratios are in parenthesis. The signs in the long-run equations must be reversed to show correct results. As HQC and SBC criteria produce exactly the same error correction results, therefore, the later estimations are not reported here.
Full results available in Appendix O-1 and Appendix O-2.

Table 5.6.2 – Error Correction Representation of the ARDL Model - Eq.(5.2)

Short-run dependent variable $\Delta\ (m_1/p)$

	With dummy				Without dummy		
	Eq.(1)	Eq.(2)	Eq.(3)	Eq.(4)	Eq.(5)	Eq.(6)	Eq.(7)
Regressor	AIC (2,2,02,0)	SBC (1,0,0,1,0)	$\overline{R}^2$ (2,2,22,0)	HQC (2,2,0,1,0)	AIC/ $\overline{R}^2$ (2,2,2,1,)	SBC (1,0,0,0,0)	HQC (2,2,01)
Δm_{t-1}	0.28695 (2.6328)		0.35622 (2.8118)	0.26856 (2.4606)	0.39627 (2.8439)		0.30600 (2.4897)
Δy_t	0.64829 (5.3630)	0.39377 (5.9988)	0.63663 (5.1348)	0.64983 (5.3256)	0.66337 (4.7724)	0.41013 (5.5361)	0.68466 (4.9754)
Δy_{t-1}	-0.26440 (-1.8615)	-0.13591 (-4.8320)	-0.27396 (-3.2033)	-0.29645 (-2.0978)	-0.28858 (-1.7717)		-0.28607 (-1.7897)
Δr_t	-0.13072 (-4.8039)		-0.19422 (-3.2033)	-0.12409 (-4.5947)	-0.16233 (-2.4760)	-0.70417 (-2.7685)	-0.068127 (-2.7374)
Δr_{t-1}			0.086499 (1.2941)		0.11281 (1.5101)		
Δw_t	0.080559 (1.2879)	0.12693 (1.9336)	0.057069 (0.85917)	0.080906 (1.2813)	-0.008666 (-0.12036)	0.072438 (1.0063)	0.021432 (0.31103)
Δw_{t-1}	-0.073830 (-1.3341)		-0.062556 (-1.0638)				
ΔD_t	0.15877 (3.7788)	0.16140 (3.6153)	0.15057 (3.5617)	0.14934 (3.5719)			
Constant	0.59674 (2.0213)	0.46611 (1.6756)	0.54967 (1.7110)	0.41096 (1.5638)	0.097366 (0.33399)	-0.88739 (-0.38353)	0.11386 (0.40370)
e_{t-1}	-0.57729 (-6.1921)	-0.54614 (-6.7263)	-0.55163 (-4.6278)	-0.51713 (-6.2048)	-0.37472 (-3.4934)	-0.36751 (-5.3450)	-0.39119 (-4.5787)
$\overline{R}^2$	0.60371	0.5314	0.60574	0.59617	0.49828	-0.39867	0.48311
F-Statistics	10.7713	12.4830	9.8689	11.8307	8.5225	9.2873	9.1221
DW	1.8910	1.4663	1.9487	1.9251	1.9350	1.5187	1.9077

Long-run equations

Eq.(1)	$ecm = m_1/p$ -0.65896*y +0.22822*r- 0.54872*w-0.27719*D -1.0418
Eq.(2)	$ecm = m_1/p$ -0.72102*y +0.24885*r- 0.48049*w - 0.29554 *D -0.85346
Eq.(3)	$ecm = m_1/p$ -0.67402*y +0.23774*r- 0.53302*w - 0.27295 *D -0.99645
Eq.(4)	$ecm = m_1/p$ -0.72207*y +0.23996*r- 0.47567*w - 0.28879 *D -0.79469
Eq.(5)	$ecm = m_1/p$ -0.95926*y +0.19112*r -0.35088 *w-0.25984
Eq.(6)	$ecm = m_1/p$ -1.1160*y +0.19161*r -0.19711 *w- 0.24146
Eq.(7)	$ecm = m_1/p$ -0.94804*y +0.17415*r -0.36546 *w- 0.2905

The t-ratios are in parenthesis. The signs in the long-run equations must be reversed to show correct results. As HQC and SBC criteria produce exactly the same error correction results, therefore, the later estimations are not reported here. Full results available in Appendix O-3 and Appendix O-5.

Table 5.6.3 – Error Correction Representation of the ARDL Model - Eq.(5.3)

Short-run dependent variable $\Delta\ (m_1/p)$

	With dummy		Without dummy	
	Eq.(1)	Eq.(2)	Eq.(3)	Eq.(4)
Regressor	$\overline{R}^2$ (2,2,2,2,2)	AIC/ SBC/HQC (2,0,0,2,0)	AIC/ $\overline{R}^2$ /HQC (2,2,2,0,)	SBC (1,0,0,0)
Δm_{t-1}	0.39067 (3.0718)	0.27185 (2.4808)	0.29134 (2.3084)	
Δy_t	0.61234 (4.5917)	0.50602 (7.3329)	0.67199 (4.9651)	0.43760 (6.3261)
Δy_{t-1}	-0.21801 (-1.4674)		-0.3000 (-1.8223)	
Δr_t	-0.20908 (-3.5461)	-0.12921 (-5.0821)	-0.16182 (2.5847)	-0.072989 (-3.0497)
Δr_{t-1}	0.11471 (1.6570)		0.11663 (1.6044)	
ΔROP_t	0.065031 (0.25827)	-0.017059 (-0.073948)	0.32009 (2.2825)	0.30459 (2.2552)
ΔROP_{t-1}	-0.52853 (-2.0228)	-0.71838 (-3.3674)		
ΔD_t	0.15955 (2.3921)	0.15676 (3.8870)		
ΔD_{t-1}	-0.11924 (-1.6304)			
Constant	0.40354 (1.8210)	0.45827	0.21694 (0.95720)	0.17210 (0.76340)
e_{t-1}	-0.54940 (-5.3004)	-0.54915 (-7.5098)	-0.37574 (-4.2667)	-0.39950 (-6.3313)
$\overline{R}^2$	0.62929	0.61713	0.52169	0.44662
F-Statistics	9.8878	12.6563	9.0765	11.0885
DW	2.0060	1.7876	1.9456	1.4869

Long-run equations

Eq.(1)	$ecm = m_1/p$ -0.92324*y +0.26093*r- 0.88504*ROP-0.31241*D -0.73450
Eq.(2)	$ecm = m_1/p$ -0.92146*y +0.23530*r- 0.95824*ROP - 0.28546 *D -0.83450
Eq.(3)	$ecm = m_1/p$ -1.0619*y +0.19505*r -0.85188 *ROP-0.57735
Eq.(4)	$ecm = m_1/p$ -1.0954*y +0.18270*r -0.76244 *ROP- 0.43079

The t-ratios are in parenthesis. The signs in the long-run equations must be reversed to show correct results. As HQC and SBC criteria produce exactly the same error correction results, therefore, the later estimations are not reported here.
Full results available in Appendix O-5 and Appendix O-6.

Table 5.6.4 – Error Correction Representation of the ARDL Model- Eq.(5.4)

short-run dependent variable Δ (m_1/p)

	With dummy				Without dummy		
	Eq.(1)	Eq.(2)	Eq.(3)	Eq.(4)	Eq.(5)	Eq.(6)	Eq.(7)
Regressor	AIC/ $\bar{R}^2$ (2,2,1,0,0)	SBC/HQC (1,0,1,0,0)	$\bar{R}^2$ (2,2,2,1,2)	HQC (1,1,1,0,0)	AIC/ $\bar{R}^2$ (2,2,1,0)	SBC (1,0,1,0)	HQC (1,1,1,0)
Δm_{t-1}	0.22039 (1.9622)		0.31029 (2.3490)		0.23698 (1.9777)		
Δy_t	0.60756 (4.45411)	0.36968 (4.7612)	0.60349 (4.5310)	0.54133 (4.3544)	0.65380 (4.6131)	0.40409 (4.9263)	0.59777 (4.5812)
Δy_{t-1}	-0.23227 (-1.5087)		-0.28246 (-1.8153)		-0.21615 (-1.3150)		
Δr_t	-0.21253 (-2.8049)	-0.23973 (-3.0901)	-0.22195 (-2.8268)	-0.24638 (-3.2446)	-0.19712 (-2.4419)	-0.22229 (-2.6858)	-0.2315 (-2.8640)
Δr_{t-1}			0.093717 (1.2453)				
ΔDCR_t	-0.029443 (-0.39732)	-0.035575 (-0.46198)	-0.057405 (-0.71055)	-0.046985 (-0.62178)	-0.085909 (-1.1333)	-0.096338 (-1.2201)	-0.10532 (-1.3680)
ΔD_t	0.11623 (2.6372)	0.12619 (2.7496)	0.15785 (2.1668)	0.11883 (2.6368)			
ΔD_{t-1}			-0.12284 (-1.5498)				
Constant	-0.19344 (-1.1903)	-0.19073 (-1.2199)	-0.37639 (-1.8518)	-0.11387 (-0.71583)	-0.092377 (-0.54742)	-0.095465 (-0.58498)	-0.014056 (-0.085378)
e_{t-1}	-0.29261 (-4.0734)	-0.32094 (-5.3856)	-0.30323 (-3.7881)	-0.26568 (-4.0061)	-0.25933 (-3.4319)	-0.29879 (-4.7275)	-023718 (-3.4020)
$\bar{R}^2$	0.54424	0.49715	0.55073	0.51943	0.47962	0.42385	0.45441
F-Statistics	9.8153	11.0867	8.2547	12.2085	9.0140	10.4456	11.9110
DW	1.8942	1.4355	1.9007	1.5064	1.8752	1.3768	1.4693

Long-run equations

Eq..(1)	$ecm = m/p_1$ -1.1368*y +0.29394*r- 0.10062*DCR-0.39721*D -0.66107
Eq.(2)	$ecm = m_1/p$ -1.1519*y +0.30159*r+0.11085*DCR - 0.39320 *D -0.59431
Eq.(3)	$ecm = m_1/p$ -1.0701*y +0.21149*r- 0.21141*DCR-0.45170*D +1.2413
Eq.(4)	$ecm = m_1/p$ -1.1300*y +0.33858*r+0.17684*DCR - 0.44726 *D -0.42860
Eq.(5)	$ecm = m_1/p$ -1.3524*y +0.28664*r +0.32243*DCR+0.31951
Eq.(6)	$ecm = m_1/p$ -1.3381*y +0.28446*r +0.33127*DCR+0.35621
Eq.(7)	$ecm = m_1/p$ -1.3597*y +0.33131*r +0.44404*DCR+0.059261

The t-ratios are in parenthesis. The signs in the long-run equations must be reversed to show correct results. As HQC and SBC criteria produce exactly the same error correction results, therefore, the later estimations are not reported here.
Full results available in Appendix O-7 and Appendix O-8.

Table 5.6.5 – Error Correction Representation of the ARDL Model- Eq.(5.5)

Short-run dependent variable $\Delta\ (m_1/p)$

	With dummy			Without dummy			
	Eq.(1)	Eq.(2)	Eq.(3)	Eq.(4)	Eq.(5)	Eq.(6)	Eq.(7)
	AIC/$\overline{R}^2$ (2,2,2,0,2)	SBC/HQC (1,1,0,0,0)	HQC (2,2,0,0,0)	AIC/ (2,2,2,0)	SBC (1,1,1,0)	$\overline{R}^2$ (2,2,2,2)	HQC (2,1,0,0))
Δm_{t-1}	0.38150 (3.2139)		0.23839 (2.3448)	0.36540 (2.8942)		0.32220 (2.4095)	0.19173 (1.8502)
Δy_t	0.67996 (5.6695)	0.63497 (5.6976)	0.69718 (5.9722)	0.70925 (5.2355)	0.65186 (5.2653)	0.73979 (5.4035)	0.62912 (5.1902)
Δy_{t-1}	-0.27642 (-2.0034)		-0.23999 (-1.7335)	0.25150 (-1.6192)		-0.23944 (-1.4740)	
Δr_t	-0.14905 (-2.3892)	-0.70909 (-2.8506)	-0.070622 (-2.9117)	-0.084763 (-1.2479)	-0.33813 (-1.3591)	-0.060272 (-0.85970)	-0.028719 (-1.1776)
Δr_{t-1}	0.14693 (2.1508)			0.13400 (1.8378)		0.13277 (1.7903)	
ΔRDG_t	0.19298 (3.2308)	0.18555 (3.4571)	0.17411 (3.3617)	0.17577 (2.6060)	0.15200 (2.5908)	0.23481 (2.4521)	0.15475 (2.7071)
ΔRDG_{t-1}						0.10350 (1.1065)	
ΔD_t	0.17291 (2.6552)	0.13842 (3.4119)	0.13311 (3.4164)				
ΔD_{t-1}	-0.12118 (-1.7147)						
Constant	-0.18368 (-2.2901)	-0.14897 (-1.9331)	-0.19368 (-2.4226)	-0.19505 (-2.1861)	-0.16594 (-1.9406)	-0.19263 (-2.1618)	-0.15502 (-1.8565)
e_{t-1}	-0.45056 (-5.4595)	-0.41069 (-6.6077)	-0.42197 (-2.4226)	-0.38779 (-4.4950)	-0.3402 (-5.2371)	-0.33768 (-3.6278)	-0.32242 (-4.9785)
$\overline{R}^2$	0.63968	0.57993	0.61608	0.53752	0.4860	0.53954	0.50721
F-Statistics	11.1961	15.0056	12.6051	9.5876	12.8161	8.6982	11.4924
DW	2.1055	1.4802	1.9228	1.9933	1.4178	2.0755	1.8191

Long-run equations

Eq.(1) $ecm = m_1/p - 0.91630*y + 0.19358*r - 0.42830*RDG - 0.31877*D + 0.40766$

Eq.(2) $ecm = m_1/p - 0.90283*y + 0.17266*r - 0.45180*RDG - 0.33705*D + 0.36273$

Eq.(3) $ecm = m_1/p - 0.93119*y + 0.16736*r - 0.41260*RDG - 0.31545*D + 0.45899$

Eq.(4) $ecm = m_1/p - 1.0404*y + 0.11548*r - 0.45235*RDG + 0.50297$

Eq.(5) $ecm = m_1/p - 1.0540*y + 0.098573*r - 0.44312*RDG + 0.48376$

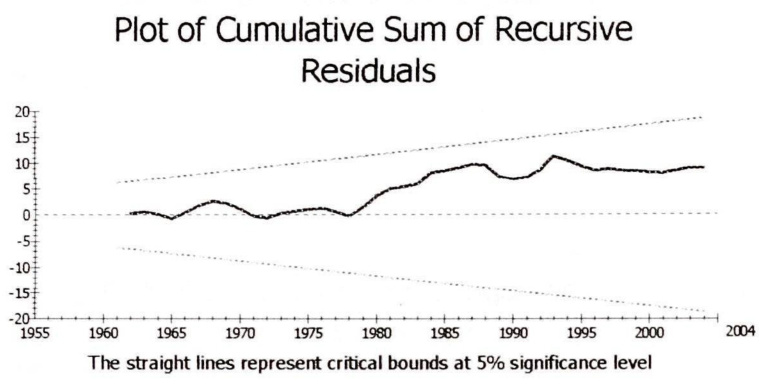
Eq.(6) $ecm = m_1/p - 1.0736*y + 0.14604*r - 0.37230*RDG + 0.57045$

Eq.(7) $ecm = m_1/p - 1.0265*y + 0.089074*r - 0.47998*RDG + 0.48079$

The t-ratios are in parenthesis. The signs in the long-run equations must be reversed to show correct results. As HQC and SBC criteria produce exactly the same error correction results, therefore, the later estimations are not reported here.
Full results available in Appendix O-9 and Appendix O-10.

The ARDL error-correction estimation results and respective appropriate lag length selection criteria are displayed. The preceding tables reveal that error correction coefficients carry the expected negative sign and are significant in all cases. The stability of the long-run coefficients will be examined together with the short-run dynamics along with the CUSUM and CUSUMSQ test proposed by Brown et al. (1975).

Figure 5.1 CUSUM and CUSUMSQ Plots for Stability Tests Eq.(5.1)without dummy



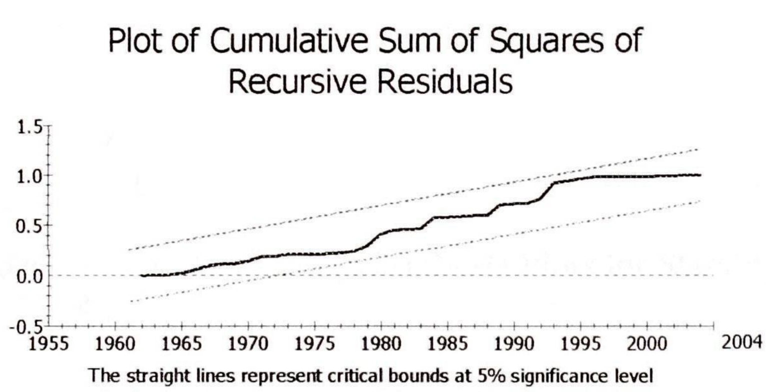
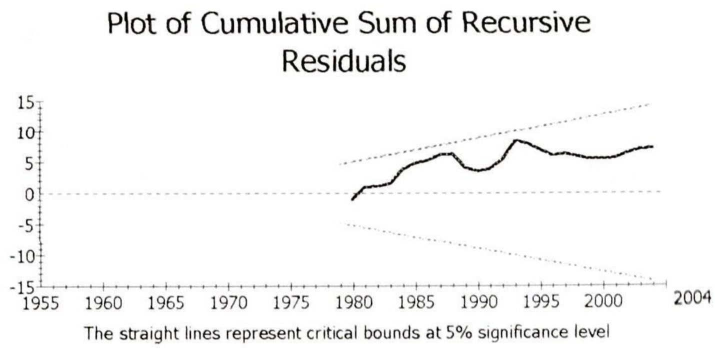


Figure 5.2 CUSUM and CUSUMSQ Plots for Stability Tests Eq.(5.1)with dummy



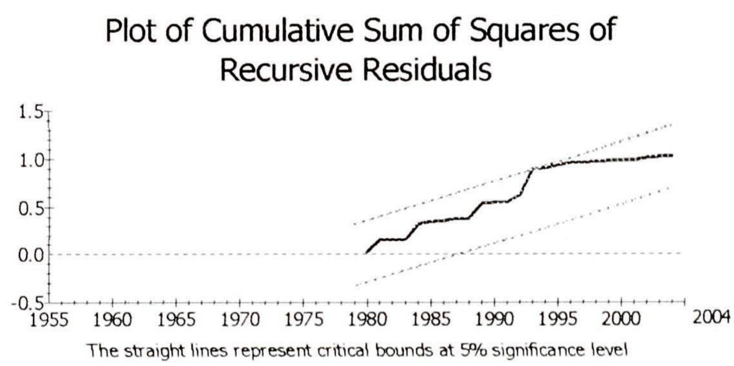
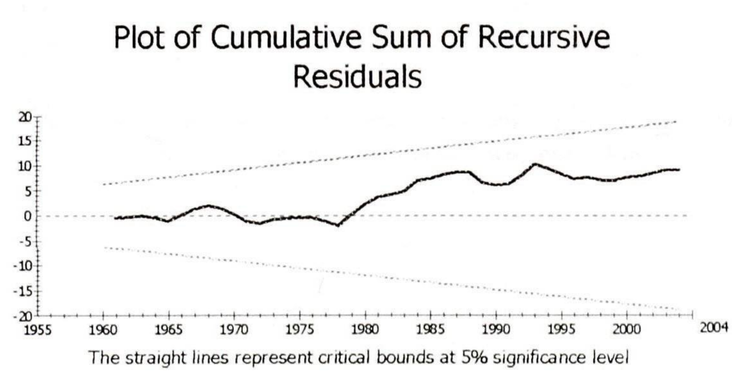


Figure 5.3 CUSUM and CUSUMSQ Plots for Stability Tests Eq.(5.2)without dummy



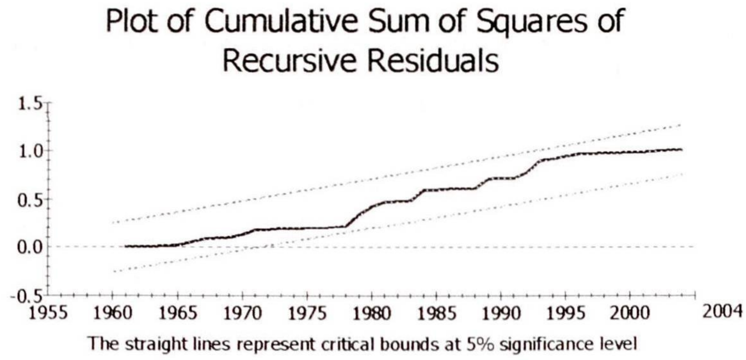
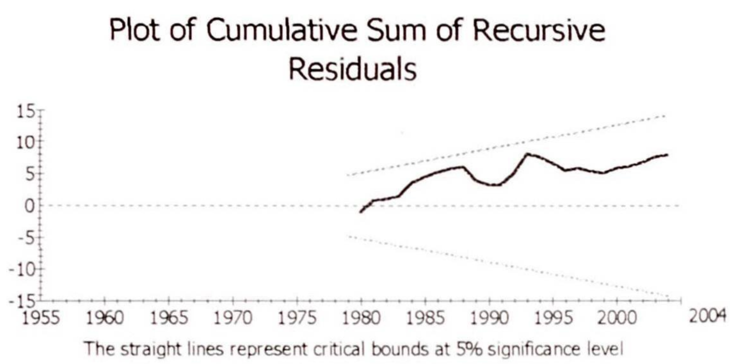


Figure 5.4 CUSUM and CUSUMSQ Plots for Stability Tests Eq.(5.2)with dummy



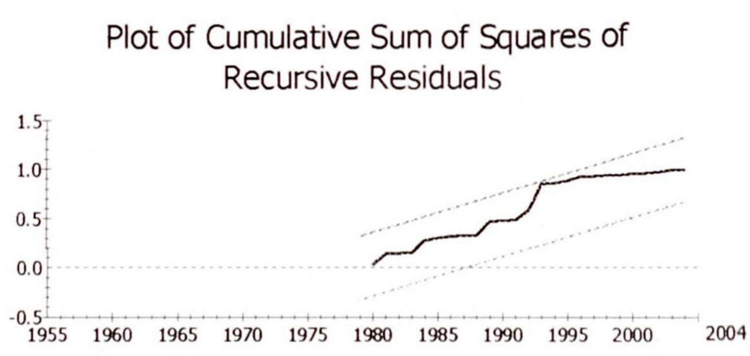
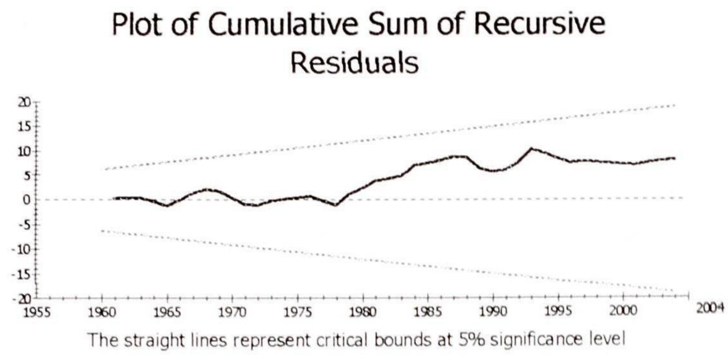


Figure 5.5 CUSUM and CUSUMSQ Plots for Stability Tests Eq.(5.3)without dummy



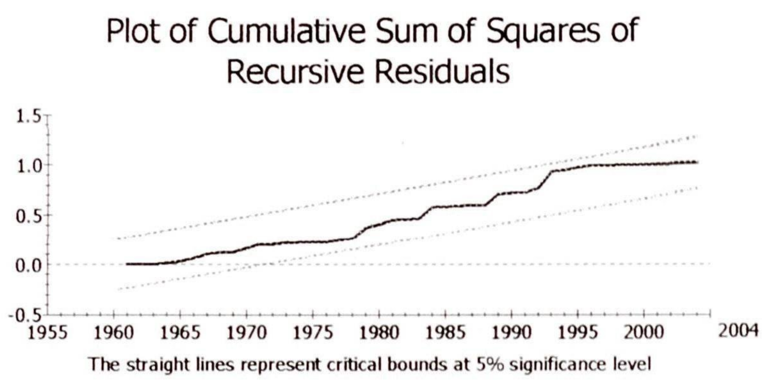
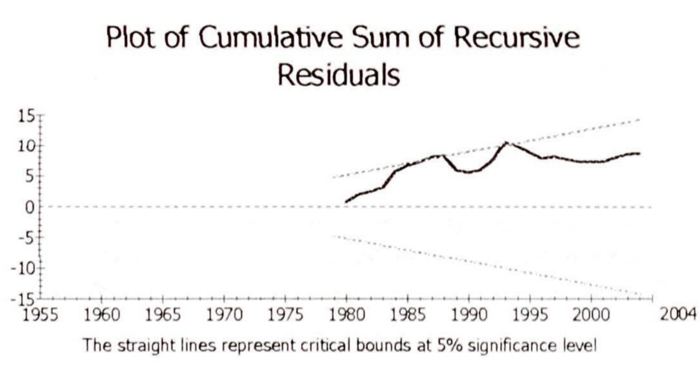


Figure 5.6 CUSUM and CUSUMSQ Plots for Stability Tests Eq.(5.3)with dummy



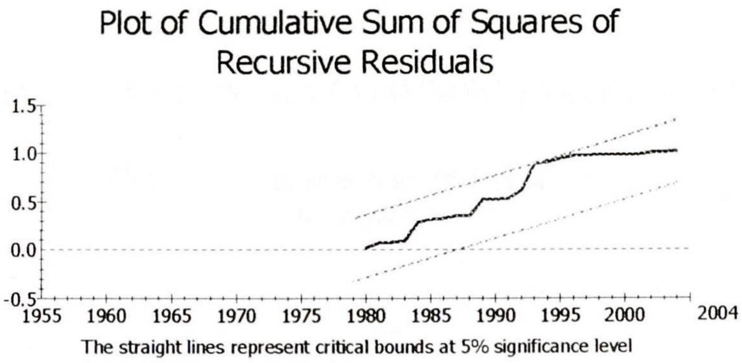
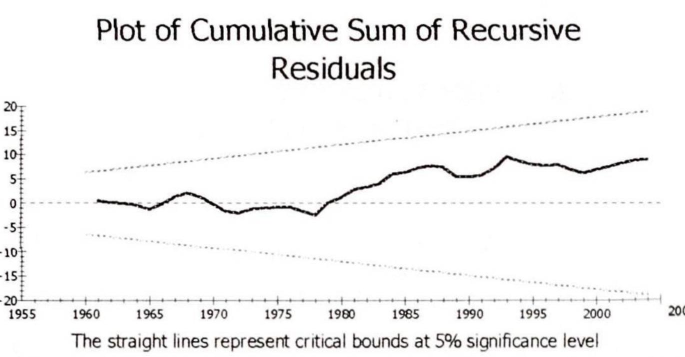


Figure 5.7 CUSUM and CUSUMSQ Plots for Stability Tests Eq. (5.4)without dummy



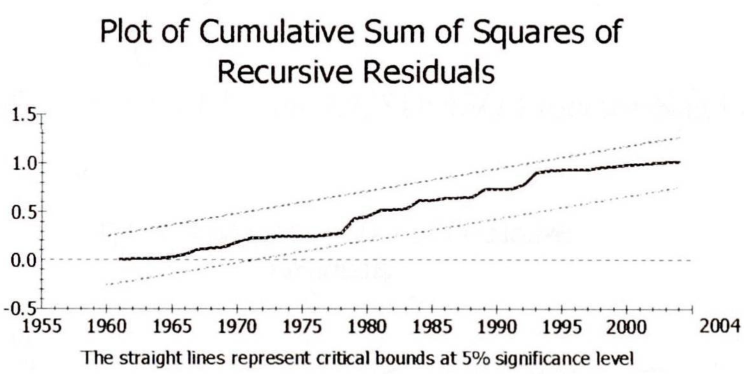
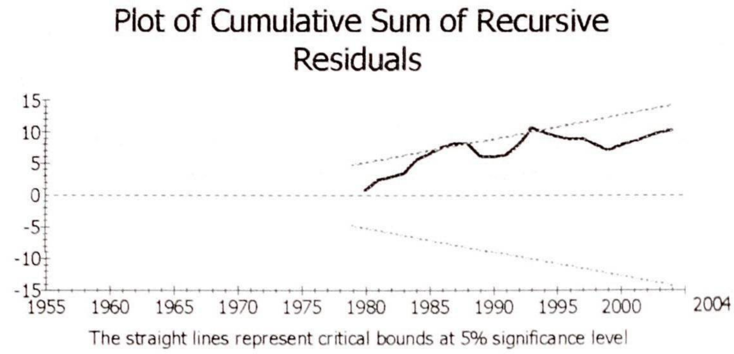


Figure 5.8 CUSUM and CUSUMSQ Plots for Stability Tests Eq.(5.4)with dummy



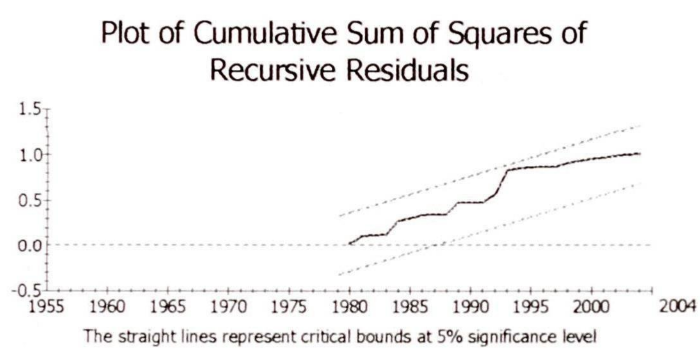
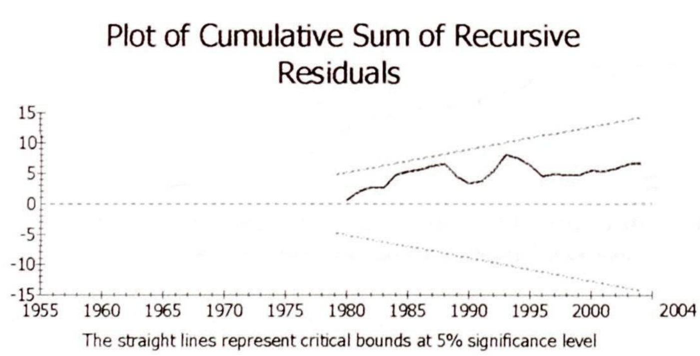


Figure 5.9 CUSUM and CUSUMSQ Plots for Stability Tests Eq.(5.5) with dummy



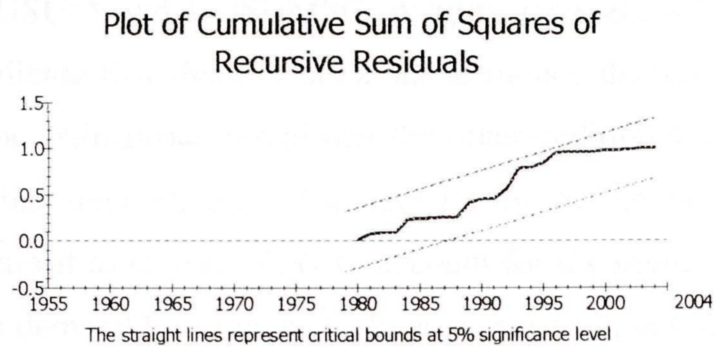
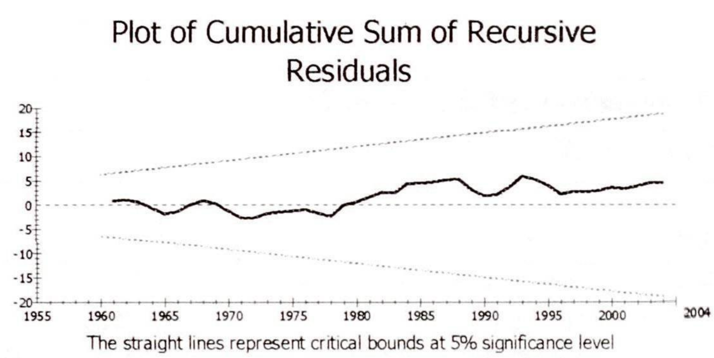
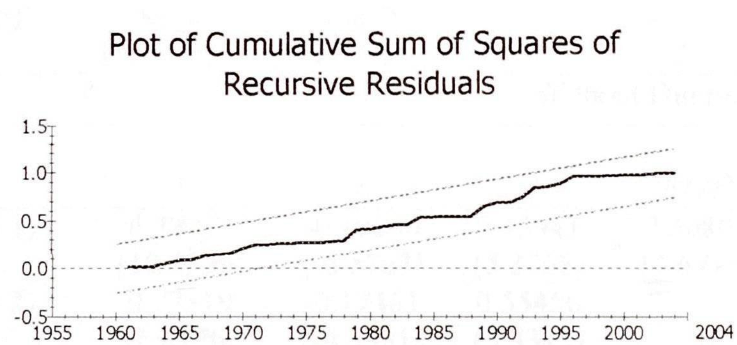


Figure 5.10 CUSUM and CUSUMSQ Plots for Stability Tests Eq.(5.5)without dummy





CUSUM and CUSUMSQ stability tests are all well within the critical bands and indicate that there exists a stable money demand function with additional variables. The estimations reveal that the other additional variables of real wage *w*, the ratio of urban population *ROP* to account for the monetization process, and the ratio of total deposit to income *RDG* to account for the saving level all have significant influences on demand for money in China except *DCR* got negative sign.

5.8 Phillips-Hansen Cointegration Approach

The Phillips-Hansen Cointegration test results are shown in below Table 5.7, and full results can be found in appendix Q. The results reveal that the coefficients have the correct signs except *DCR* and there is a long-run relationship between the variables. These results are very similar to the ones estimated from above bound testing.

Table 5.7 Phillips-Hansen Cointegration Tests

				With Dummy			
	y	*r*	*w*	*ROP*	*DCR*	*RDG*	*D*
Eq.(5.1)	0.72365	-0.27866	0.31608	0.42423			0.36658
	(15.6519)	(-14.9710)	(6.3155)	(3.9598)			(9.9306)
Eq.(5.2)	0.83701	-0.28395	0.28190				0.42823
	(11.3748)	(-9.5463)	(3.8370)				(7.2268)
Eq.(5.3)	1.0080	-0.29188		0.62692			0.27237
	(19.2465)	(-8.9372)		(3.6565)			(4.2083)
Eq.(5.4)	1.0864	-0.28418			0.20702		0.36471
	(16.8784)	(-3.9279)			(1.2198)		(3.3012)
Eq.(5.5)	0.98426	-0.20630				0.35388	0.26501
	(16.4952)	(-4.6703)				(3.9123)	(3.4887)
				Without Dummy			
	y	*r*	*w*	*ROP*	*DCR*	*RDG*	
Eq.(5.1)	0.77952	-0.19030	0.45941	0.30801			
	(10.4239)	(-6.5762)	(5.3268)	(1.6716)			
Eq.(5.2)	0.77519	-0.17461	0.55456				
	(8.0176)	(-4.5931)	(5.3375)				
Eq.(5.3)	1.1180	-0.2209		0.65105			
	(17.6575)	(-5.5139)		(2.7846)			
Eq.(5.4)	1.2873	-0.28225			-0.079614		
	(32.0532)	(-3.0786)			(-0.39987)		
Eq.(5.5)	1.0523	-0.13268				0.43036	
	(17.3411)	(-2.6056)				(3.8577)	

Full results available in Appendix Q.

5.9 Johansen Cointegration Approach

On implementing the Johansen maximum likelihood co-integration approach, the lag structure of the VAR system is selected on the basis of AIC and SBC values which are reported in Table 5.8.

Table 5.8 – The Order of the VAR Model

Without dummy						
Variable	Eq.(5.1)		Eq.(5.2)		Eq.(5.3)	
	AIC	SBC	AIC	SBC	AIC	SBC
4	233.3630	134.0425	138.5176	74.1957	223.9280	159.6061
3	229.9881	154.3152	139.8004	90.6131	218.1753	168.9880
2	238.3748	186.3498	146.2919	112.2391	219.8657	185.8129
1	229.3089	200.9316	143.2633	124.3451	208.1775	189.2593
0	2.5761	-2.1534	-56.1922	-59.9759	-22.6155	-26.3991
Variable	Eq.(5.4)		Eq.(5.5)			
4	174.7832	110.4613	175.7905	111.4686		
3	167.5764	118.3891	170.5632	121.3759		
2	163.9518	129.8991	170.9120	136.8592		
1	162.1190	143.2008	167.1773	148.2591		
0	-54.8119	-58.5956	-59.5122	-63.2958		
With dummy						
Variable	Eq.(5.1)		Eq.(5.2)		Eq.(5.3)	
4	352.7197	210.8331	238.1475	138.8269	243.2427	143.9222
3	332.5818	224.7481	229.5075	153.8347	239.6295	163.9567
2	341.3385	267.4475	238.0098	185.9848	246.4696	194.4445
1	317.6483	277.9200	229.5136	201.1363	237.3575	208.9802
0	11.0353	5.3599	-48.5990	-53.3285	-16.8105	-21.5401
Variable	Eq.(5.4)		Eq.(5.5)			
4	197.1614	97.8409	201.5569	102.2363		
3	187.4745	111.8017	191.3020	115.6292		
2	186.1827	134.1577	194.7994	142.7744		
1	190.1728	161.7955	196.4446	168.0673		
0	-47.7172	-52.4467	-50.8519	-55.5815		

Full results available in Appendix R. Other lag length selection criteria are not reported although they reveal the same results.

The Johansen cointegration test is performed with a constant term but without a linear time trend. The summary results of the test are presented in Tables 5.9.1 -5.9.5. The full results can be found in Appendix R.

Table 5.9.1 – Johansen Cointegration Tests and Results - Eq.(5.1)

Panel A: the results of the λ-max and trace tests

Variables: $m_1/p, y, r, w, ROP$ (without dummy)

Null	Alternative	λ-max statistic	95% critical value	Trace statistic	95% critical value
$r=0$	$r=1$	35.9661	34.40	81.4598	75.98

Panel B: estimate of cointegrating vector

m_1/p	Constant	y	r	w	ROP
1.000	1.9482	0.62190	-0.17153	0.57291	0.50931
	(0.43845)	(0.11590)	(0.026405)	(0.14847)	(0.18662)

Panel C: vector error correction model

Dependent Variable	$\Delta m_t/p$	Δy_t	Δr_t	Δw_t	ΔROP_t
Error Correction Term	-0.54362	0.091645	0.51116	0.84415	0.033908
	(3.4523)	(0.67543)	(1.7775)	(2.8063)	0.50731

Variables: $m_1/p, y, r, w, ROP$ (with dummy)

Null	Alternative	λ-max statistic	95% critical value	Trace statistic	95% critical value
$r=0$	$r=1$	86.5449	40.53	181.9328	102.56
$r\leq 1$	$r\geq 2$	53.3705	34.40	95.3878	765.98

Panel B: estimate of cointegrating vector

m_1/p	Constant	y	r	w	ROP
1.000	-2.2966	1.5195	-0.33158	0.60302	0.25296
	(1.0950)	(0.17235)	(0.093497)	None	0.62180

Panel C: vector error correction model

Dependent Variable	$\Delta m_t/p$	Δy_t	Δr_t	Δw_t	ΔROP_t	ΔD_t
Error –Term	-0.85135	-0.17141	0.49796	1.4125	-0.16515	-0.36254
	(-4.8114)	(-0.92261)	(1.3775)	(4.7345)	(-1.8098)	(-1.2999)

In panel A: r = number of cointegrating vectors. In panel B: values in parenthesis are standard errors. In panel C: values in parenthesis are values of t-statistics. Full results available in Appendix R-1 and Appendix R-2.

Table 5.9.2 – Johansen Cointegration Tests and Results -Eq.(5.2)

Panel A: the results of the λ-max and trace tests

Variables: $m_1/p, y, r, w$ (without dummy)

Null	Alternative	λ-max statistic	95% critical value	Trace statistic	95% critical value
$r = 0$	$r = 1$	30.2837	28.2700	68.1554	53.4800
$r \leq 1$	$r \geq 2$			34.8700	31.9300

Panel B: estimate of cointegrating vector

m_1 / p	Constant	y	r	W
1.000	2.0551	0.48259	-0.17368	0.86335
	(0.68001)	(0.17233)	(0.036339)	(0.18632)

Panel C: vector error correction model

Dependent Variable	$\Delta m_t / p$	Δy_t	Δr_t	Δw_t
Error Correction Term	-0.27140	0.13933	0.27346	0.92090
	(-1.8967)	(1.1465)	(1.1261)	(3.9826)

Variables: $m_1/p, y, r, w$ (with dummy)

Null	Alternative	λ-max statistic	95% critical value	Trace statistic	95% critical value
$r = 0$	$r = 1$	86.0464	34.40	161.8359	75.98
$r \leq 1$	$r \geq 2$	50.5211	28.27	75.7895	53.48

Panel B: estimate of cointegrating vector

m_1 / p	Constant	y	r	W	D
1.000	-3.3145	1.7250	-0.34303	0.78976	0.80292
	(0.26074)	(0.13499)	(0.12790)	(0.29530)	(0.26074)

Panel C: vector error correction model

Dependent Variable	$\Delta m_t / p$	Δy_t	Δr_t	Δw_t	ΔD_t
Error –Term	-0.66928	-0.21559	0.39968	1.1794	-0.30928
	(-4.7928)	(-1.4987)	(1.3835)	(4.9711)	(-1.3898)

In panel A: r = number of cointegrating vectors. In panel B: values in parenthesis are standard errors. In panel C: values in parenthesis are values of t-statistics. Full results available in Appendix R-3 and Appendix R-4.

Table 5.9.3 – Johansen Cointegration Tests and Results -Eq.(5.3)

Panel A: the results of the λ-max and trace tests

Variables: $m_1/p, y, r, ROP$ (without dummy)

Null	Alternative	λ-max statistic	95% critical value	Trace statistic	95% critical value
$r = 0$	$r = 1$	52.7108	28.27	77.5481	53.4800

Panel B: estimate of cointegrating vector

m_1/p	Constant	y	r	ROP
1.000	-2.4130	1.6440	-0.046460	-0.87617
	(3.8520)	(0.70372)	(0.23433)	(2.2061)

Panel C: vector error correction model

Dependent Variable	$\Delta m_t / p$	Δy_t	Δr_t	ΔROP_t
Error Correction Term	-0.13384	-0.088578	0.055027	-0.034205
	(-8.9334)	(-6.2826)	(1.8540)	(-4.4908)

Variables: $m_1/p, y, r, ROP$ (with dummy)

Null	Alternative	λ-max statistic	95% critical value	Trace statistic	95% critical value
$r = 0$	$r = 1$	56.1393	34.40	96.7822	75.98
$r \leq 1$	$r \geq 2$				

Panel B: estimate of cointegrating vector

m_1/p	Constant	y	r	ROP	D
1.000	0.54276	1.1189	-0.23650	0.10569	0.45652
	(1.2413)	(0.19847)	(0.096758)	(0.71311)	(0.23724)

Panel C: vector error correction model

Dependent Variable	$\Delta m_t / p$	Δy_t	Δr_t	ΔROP_t	ΔD_t
Error –Term	-0.27556	-0.16940	0.089921	-0.071367	-.045050
	(-9.1816)	(-5.6436)	(1.4695)	(-4.6440)	(-0.95019)

In panel A: r = number of cointegrating vectors. In panel B: values in parenthesis are standard errors. In panel C: values in parenthesis are values of t-statistics. Full results available in Appendix R-5 and Appendix R-6.

Table 5.9.4 – Johansen Cointegration Tests and Results -Eq.(5.4)

Panel A: the results of the λ-max and trace tests

Variables: $m_1/p, y, r, DCR$ (without dummy)

Null	Alternative	λ-max statistic	95% critical value	Trace statistic	95% critical value
$r = 0$	$r = 1$	55.2330	28.27	96.2806	53.48
$r \leq 1$	$r \geq 2$	31.0118	22.04	41.0476	34.87

Panel B: estimate of cointegrating vector

m_1 / p	Constant	y	r	DCR
1.000	3.6336	1.6996	-0.90083	2.2027
	(0.40704)	(0.14559)	(0.23824)	None

Panel C: vector error correction model

Dependent Variable	$\Delta m_t / p$	Δy_t	Δr_t	ΔDCR_t
Error Correction Term	-0.052196	-0.027884	0.076264	0.010562
	(-6.0748)	(-3.2982)	(5.1585)	(0.70409)

Variables: $m_1/p, y, r, DCR$(with dummy)

Null	Alternative	λ-max statistic	95% critical value	Trace statistic	95% critical value
$r = 0$	$r = 1$	59.4627	34.40	112.2485	75.98
$r \leq 1$	$r \geq 2$	31.1186	28.27		

Panel B: estimate of cointegrating vector

m_1 / p	Constant	y	r	DCR	D
1.000	-3.8169	0.84002	0.34170	1.6184	0.75078
	(2.4596)	(0.29558)	(0.50532)	(1.3042)	(0.44697)

Panel C: vector error correction model

Dependent Variable	$\Delta m_t / p$	Δy_t	Δr_t	ΔDCR_t	ΔD_t
Error –Term	-0.17132	-0.10499	0.098493	-0.083808	-0.016323
	(-9.8802)	(-5.8641)	(2.7961)	(-0.26145)	(-0.56537)

In panel A: r = number of cointegrating vectors. In panel B: values in parenthesis are standard errors. In panel C: values in parenthesis are values of t-statistics. Full results available in Appendix R-7 and Appendix R-8.

Table 5.9.5 – Johansen Cointegration Tests and Results -Eq.(5.5)

Panel A: the results of the λ-max and trace tests					
Variables: $m_1/p, y, r, RDG$ (without dummy)					
Null	Alternative	λ-max statistic	95% critical value	Trace statistic	95% critical value
$r = 0$	$r = 1$	55.5099	28.27	83.2713	53.4800
Panel B: estimate of cointegrating vector					
m_1 / p		Constant	y	r	RDG
1.000		1.5086 (1.3325)	1.7828 (0.89319)	-0.083296 (0.25196)	0.60205 (1.3418)
Panel C: vector error correction model					
Dependent Variable		$\Delta m_t / p$	Δy_t	Δr_t	ΔRDG_t
Error Correction Term		-0.10926 (-8.6871)	-0.072327 (-6.1632)	0.042043 (1.7078)	-0.062190 (-3.6643)
Variables: $m_1/p, y, r, RDG$ (with dummy)					
Null	Alternative	λ-max statistic	95% critical value	Trace statistic	95% critical value
$r = 0$	$r = 1$	59.3651	34.40	100.9336	75.98
Panel B: estimate of cointegrating vector					
m_1 / p	Constant	y	r	RDG	D
1.000	0.72715 (0.40557)	1.1314 (0.22051)	0.20907 (0.13191)	0.011308 (0.39341)	0.53494 (0.28064)
Panel C: vector error correction model					
Dependent Variable	$\Delta m_t / p$	Δy_t	Δr_t	ΔRDG_t	ΔD_t
Error –Term	-0.23265 (-9.1069)	-0.14692 (-5.8696)	0.075813 1.4627	-0.12689 (-3.5551)	-0.034784 (-0.86501)

In panel A: r = number of cointegrating vectors. In panel B: values in parenthesis are standard errors. In panel C: values in parenthesis are values of t-statistics. Full results available in Appendix R-9 and Appendix R-10.

SBC, AIC test suggest that the appropriate order of VAR is one for Eq.(5.2), Eq.(5.4) and Eq.(5.5) and VAR is two for Eq.(5.1) and Eq.(5.3). The results of the eigenvalue and trace statistics are reported in Tables 5.9.1 to 5.9.5. Eigenvalue and trace statistics suggest that there is at least one possible long-run relationship at the 95% and 90% level of significance for each equation in the VAR. The estimate of this vector is normalized on dependent variable by setting the coefficient to one. Tables 5.9.1 to 5.9.5 reveal that the other additional variables of real wage index w, the ratio of urban population *ROP*, and the ratio of total deposit to income *RDG* have significant effects. Most variables have correct signs which are consistent with Pesaran et al. (2001) and Phillip-Hansen tests except that *DCR* have negative signs from Pesaran et al. (2001) test but have positive sign in Johansen. This indicates that *DCR* is no help for explaining the money demand functions in China.

5.10 Chow Parameter Constancy Test

The Chow parameter constancy test enable to estimate a linear regression equation recursively, this test plots the coefficients and standard errors of each of the variables, if the coefficients fall within the bands standard errors then the variable is considered stable over the period estimated.

The coefficient of following each variable falls within the bands set by the variable standard errors, the variables could be considered stable over the period estimated. The full reports are available in Appendix S.

Figure 5.11 – Chow test for y Eq.(5.1)

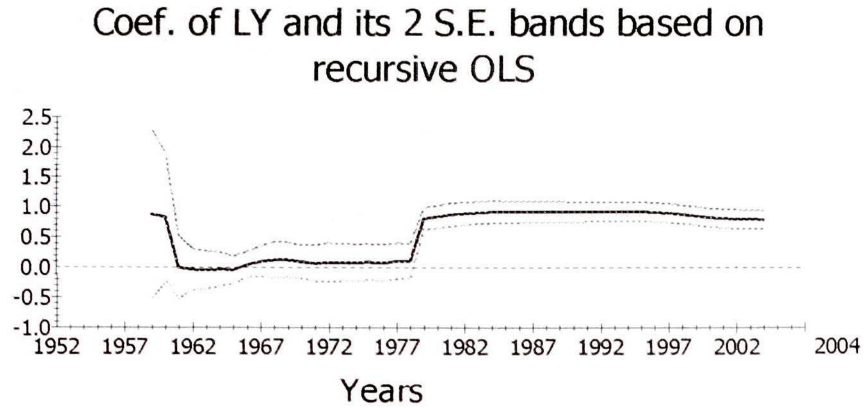


Figure 5.12 Chow test for r Eq.(5.1)

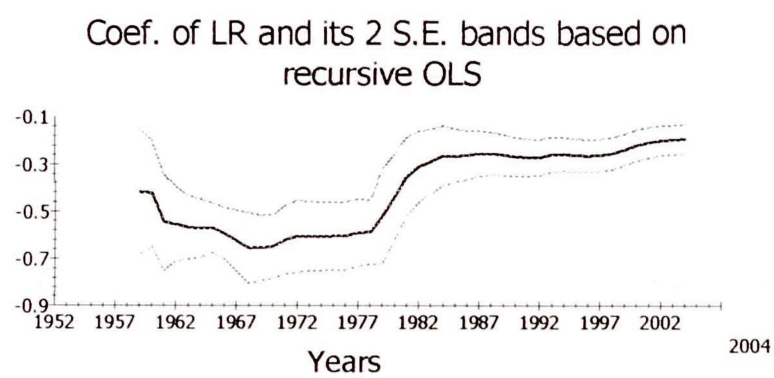


Figure 5.13 Chow test for w Eq.(5.1)

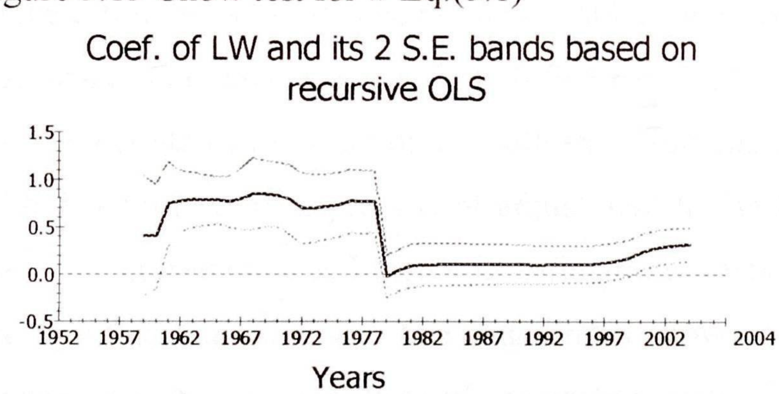


Figure 5.14 Chow test for *ROP* Eq.(5.1)

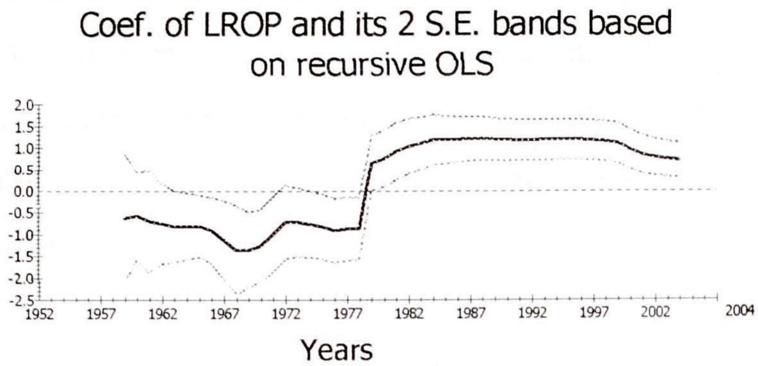
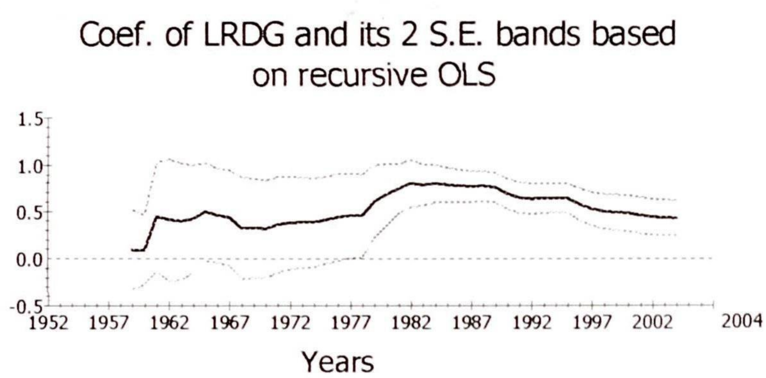


Figure 5.15 Chow test for *RDG* Eq.(5.5)



5.11 Summary and Conclusions

In the estimations of models, all the variables included in the same regression are non-stationary and integrated at first difference. ECM shows that the money demand equation contains information on both short-run and long-run properties of the model with disequilibria as a process of adjustment to the long-run model and importantly the error correction coefficients in estimations carry the expected negative sign and are significant in all cases. The wage index shows that it has a positive effect on the demand for money regardless of precisely which other variables are included in the function. Many of the previous studies found the income elasticity of demand for money very high and more than unity (Qin, 1994). This study found that adding the wage index and a proportion of monetization process *ROP* into the money demand function, the income elasticity falls closer to its expected value of unity. The prediction of the hypothesis of *RDG* is meaningful in that the increase of saving level will lead to the increase in the money demand. It is found that since the reforms, monetization process made the money play a more vital role. However, the testing from Eq. (5.4) with *DCR* ratio is no help for explaining the demand for money function in China.

By and large, real income, real interest rate, real wage index, ratio of urban population, ratio of deposit to income have all been shown as important variables influencing money demand in China. A relatively constant stable relationship of money demand with additional variables existed for the period 1952-2004 overall. Table 5.10 summarizes the results of the money demand functions in China with dummy and additional variables.

Table 5.10 Summary of Estimation Results of Long-run Money Demand in China with Dummy and Additional Other Variables 1952-2004

Summary of Phillips-Hansen Cointegration tests

	y	r	w	ROP	DCR	RDG
Eq.(5.1)	0.72365	-0.27866	0.31608	0.42423		
	(15.6519)	(-14.9710)	(6.3155)	(3.9598)		
Eq.(5.2)	0.83701	-0.28395	0.28190			
	(11.3748)	(-9.5463)	(3.8370)			
Eq.(5.3)	1.0080	-0.29188		0.62692		
	(19.2465)	(-8.9372)		(3.6565)		
Eq.(5.4)	1.0864	-0.28418			0.20702	
	(16.8784)	(-3.9279)			(1.2198)	
Eq.(5.5)	0.98426	-0.20630				0.35388
	(16.4952)	(-4.6703)				(3.9123)

Summary of Pesaran *et al.* (2001) tests

		y	r	w	ROP	DCR	RDG
(AIC)	Eq.(5.1)	0.62983	-0.22856	0.42194	0.64095		
		(10.0769)	(-11.0893)	(5.1697)	(4.7827)		
(AIC)	Eq.(5.2)	0.65896	-0.22822	0.54872			
		(5.6629)	(-6.5514)	(4.5408)			
(AIC)	Eq.(5.3)	0.92146	-0.23530		0.95824		
		(16.4342)	(-6.8117)		(5.0811)		
(AIC)	Eq.(5.4)	1.1368	-0.29394			-0.10062	
		(12.6463)	(-2.7657)			(-0.39660)	
(AIC)	Eq.(5.5)	0.91630	-0.19358				0.42830
		(12.5450)	(-3.7300)				(3.7264)
(SBC)	Eq.(5.1)	0.67929	-0.22944	0.34542	0.66746		
		(9.4105)	(-9.5183)	(3.8947)	(4.3035)		
(SBC)	Eq.(5.2)	0.72102	-0.24885	0.48049			
		(6.1317)	(-6.4862)	(3.9103)			
(SBC)	Eq.(5.3)	0.92146	-0.23530		0.95824		
		(16.4342)	(-6.8117)		(5.0811)		
(SBC)	Eq.(5.4)	1.1519	-0.30159			-0.11085	
		(13.7547)	(-3.0857)			(-0.46537)	
(SBC)	Eq.(5.5)	0.90283	-0.17266				0.45180
		(11.1410)	(-3.1464)				(3.7469)

Stability Tests (From ARDL)

	Eq.(5.1)	Eq.(5.2)	Eq.(5.3)	Eq.(5.4)	Eq.(5.5)
CUSUM	Yes	Yes	Yes	Yes	Yes
CUSUMSQ	Yes	Yes	Yes	Yes	Yes

Table 5.10 (Continued)

Summary of Johansen Cointergration tests

Panel A: the results of the λ-max and trace tests Eq.(5.1)

Null	Alternative	λ-max statistic	95% critical value	Trace statistic	95% critical value
$r=0$	$r=1$	86.5449	40.53	181.9328	102.56
$r \le 1$	$r \ge 2$	53.3705	34.40	95.3878	765.98

Panel B: estimate of Cointegration Vector

m_1/p	y	r	w	ROP
-1.000	1.5195	-0.33158	0.60302	0.25296

Panel A: the results of the λ-max and trace tests Eq.(5.2)

Null	Alternative	λ-max statistic	95% critical value	Trace statistic	95% critical value
$r=0$	$r=1$	86.0464	34.40	161.8359	75.98
$r \le 1$	$r \ge 2$	50.5211	28.27	75.7895	53.48

Panel B: estimate of Cointegration Vector

m_1/p	y	r	w
-1.000	1.7250	-0.34303	0.78976

Panel A: the results of the λ-max and trace tests Eq.(5.3)

Null	Alternative	λ-max statistic	95% critical value	Trace statistic	95% critical value
$r=0$	$r=1$	56.1393	34.40	96.7822	75.98

Panel B: estimate of Cointegration Vector

m_1/p	y	r	ROP
-1.000	1.1189	-0.23650	0.10569

Panel A: the results of the λ-max and trace tests Eq.(5.4)

Null	Alternative	λ-max statistic	95% critical value	Trace statistic	95% critical value
$r=0$	$r=1$	59.4627	34.40	112.2485	75.98
$r \le 1$	$r \ge 2$	31.1186	28.27		

Panel B: estimate of Cointegration Vector

m_1/p	y	r	DCR
-1.000	0.84002	0.34170	1.6184

Table 5.10 (Continued)

Panel A: the results of the λ-max and trace tests Eq.(5.5)

Null	Alternative	λ-max statistic	95% critical value	Trace statistic	95% critical value
$r = 0$	$r = 1$	59.3651	34.40	100.9336	75.98

Panel B: estimate of Cointegration Vector

m_1 / p	y	r	RDG
-1.000	1.1314	0.20907	0.011308

Hypothesis Testing of Income Coefficient Via Wald Tests

	Variable	Statistics	Prob.
Eq.(5.1)	m_1 / p	19.7393*	[0.000]
Eq.(5.2)	m_1 / p	5.6290*	[0.018]
Eq.(5.3)	m_1 / p	1.9620	[0.161]
Eq.(5.4)	m_1 / p	3.2896*	[0.070]
Eq.(5.5)	m_1 / p	1.4378	[0.230]

Eq.(5.1) $(m/p)_t = a + by_t + cr_t + dw_t + eROP_t + u_t$

Eq. (5.2) $(m/p)_t = a + by_t + cr_t + dw_t + u_t$

Eq. (5.3) $(m/p)_t = a + by_t + cr_t + dROP_t + u_t$

Eq. (5.4) $(m/p)_t = a + by_t + cr_t + dDCR_t + u_t$

Eq. (5.5) $(m/p)_t = a + by_t + cr_t + dRDG_t + u_t$

Chapter 6 Summary and Conclusions

6.1 Introduction

This study estimates money demand functions in China over the period 1952-2004 with three definitions of money of m_0, m_1, and m_2 through a comparison of various estimations. Numerous empirical investigations of the demand for money functions for both short-run and long-run in both DCs and LDCs have been provided by many economists in the past. The study of money demand is always important when designing monetary policy. Studies relating LDCs have yielded additional evidence on the role of money demand and its determinants and provided a useful framework for research in China. In this study, we provided a literature review with a brief analysis of the existing theories and empirical studies on money demand in different countries. The analysis of literature review extends previous work by Sriram (2001) into 2000s.

This study has attempted to give an overview of the monetary sector of the Chinese economy and the patterns of the money demand functions in China. In recent years, the performance of Chinese authorities have accelerated the reforms of the banking system and the financial sector and moved to a system of monetary control through indirect, market based instruments. The central bank PBC has more ability to forecast the quantity of money which consumers demanded while maintaining a certain level of national income and rate of inflation. This study also explores additional variables and presents some other influences such as the monetization process and saving effects on money demand in China. There have been growing efforts among economics to re-examine the money demand function in China. The development of money demand equation is of great importance. Through the whole study, it is found that the coefficients estimated from data over different time periods do not alter significantly. A long-run stable money demand function exists in China. The stability tests study implies that the demand for money is highly predictable, it give the values of the explanatory variables, the estimated equation predicted or estimated a more accurate value for the demand for money.

6.2 Main Empirical Findings

Main findings from chapter 4 of long-run money demand tested with different cointegration procedure are listed in the following Table 6.1 which indicates that it is necessary to add an appropriate dummy variables into the money demand function to evaluate effects of economic reform in China. This study extends Yi's early work. It reveals that the economic reform did bring significant changes to the Chinese economy. The estimated results from Pesaran, Phillips-Hansen and Johansen cointegration analysis are more or less similar indicating that the estimations are robust except nominal money demand model with Johansen cointegration tests. Income is shown to be the most important determinant of money demand, but the interest rates of m_0 and m_2 have the wrong signs. The signs of interest rate of real m_1 are consistent using different methodologies. A Granger Causality test indicates that there is unidirectional causality between real income and real money demand for m_1 and there is bi-directional causality between currency in circulation m_0 and real income. There is no Granger Causality relation between the broad money m_2 and income. The hypothesis testing of income coefficients via the Wald test is performed and reveals that most equations do not reject the null hypothesis.

Table 6.1 – Summary of Cointegration Tests (Long-run with dummy)

Pesaran *et al.* (2001)						
Real money demand			Normal money demand			
	Real income	Interest Rate		Real income	Interest Rate	Inflation
m_0/p	1.0934	-0.085041	m_0	1.0595	-0.045966	1.0841
m_1/p	1.0908	-0.28526	m_1	1.1315	-0.13404	1.0068
m_2/p	1.3987	0.056472	m_2	1.5630	0.38231	0.94568
Phillips-Hansen						
m_0/p	1.3341	0.085954	m_0	0.98385	-0.060892	1.5409
m_1/p	1.1800	-0.28290	m_1	0.97717	-0.39246	1.2963
m_2/p	1.6208	-0.008865	m_2	1.0646	-0.31585	1.8310
Johansen						
m_0/p	1.1670	0.082789	m_0	3.5136	2.7982	-1.9490
m_1/p	1.1424	-0.22557	m_1	3.0396	1.7259	-1.4787
m_2/p	0.52064	-0.12738	m_2	0.078540	-1.3570	3.2643

Table 6.2 – Summary of Cointegration Tests with additional variables (Long-run with dummy)

Dependent variable m_1/p

	y	r	w	ROP	DCR	RDG
			Pesaran *et al.* (2001)			
Eq.(5.1)	0.62983	-0.22856	0.42194	0.64095		
Eq.(5.2)	0.65896	-0.22822	0.54872			
Eq.(5.3)	0.92146	-0.23530		0.95824		
Eq.(5.4)	1.1368	-0.29394			-0.10062	
Eq.(5.5)	0.91630	-0.19358				0.42830
			Phillips-Hansen			
Eq.(5.1)	0.72365	-0.27866	0.31608	0.42423		
Eq.(5.2)	0.83701	-0.28395	0.28190			
Eq.(5.3)	1.0080	-0.29188		0.62692		
Eq.(5.4)	1.0864	-0.28418			0.20702	
Eq.(5.5)	0.98426	-0.20630				0.35388
			Johansen			
Eq.(5.1)	1.5195	-0.33158	0.60302	0.25296		
Eq.(5.2)	1.7250	-0.34303	0.78976			
Eq.(5.3)	1.1189	-0.23650		0.10569		
Eq.(5.4)	0.84002	0.34170			1.6184	
Eq.(5.5)	1.1314	0.20907				0.011308

Table 6.2 summarizes the main findings from chapter 5 with additional variables and indicates that the real wage index w, the ratio of urban population to total population *ROP*, and the ratio of total deposit to income *RDG* all have significant effects. *DCR* is of no help for explaining the money demand relationship with its determinants. Table 6.2 demonstrates that the estimations results from Pesaran and Phillips-Hansen are more or less similar.

6.3 The Main Conclusions and Findings

1) The real money demand functions perform better than the nominal money demand functions. The money demand with appropriate dummy variable performs better than without it. The appropriate money demand function is the real money demand for m_1 which has better performance in comparison with the other two definitions of money.

2) The income elasticity falls closer to its expected value of unity when additional other variables such as wage index, monetization process and saving effects are considered in the same money demand function.

3) The evidence suggests that it is unwise to neglect the role of real wage rate as it plays an important role in both transactions and precautionary motives for holding money.

4) Since the reforms, monetization process plays a more vital role in the money demand function.

5) Saving effects have some positive influence on money demand. Increase in saving levels will lead to the increase in the money demand.

6.4 Policy Implications

From various estimations reported in both chapters 4 and 5, it is found that the models contain cointegration relationship which reveals that a stable long-run equilibrium demand for money function exist in China. The stability issue in money demand functions is very important in order to test the effectiveness of the monetary programme. The stabilization policy should primarily aim at the narrow money m_1.

The analysis of other additional variables provides significant information on policy making.

- The impact of wage index on money demand models is important. Previous studies in developed countries present evidence on the effect of wages on money demand. The wage parameter in a demand for money equation is found to be positive (Kevin, 1990). The role of the wage index in China as a proxy variable is useful in determining the transaction and precautionary motives for money holding.
- Increases in the monetization process have made the money play a more vital role in the Chinese economy. As in recent years, Chinese people have aspired to own property, notably houses, durable consumer commodities and automobiles. The availability of a range of savings instruments, such as stock and bonds, has attracted households to use these instruments provided by Banks or non-Bank financial institutions. This suggests that the growth rate of money supply should accommodate both the GDP growth and monetization process.

- In most equations of our study, it was found there is a significant negative intercept before and after economic reform. This may be explained by the fact that Chinese people have always been cautious about using money.
- The average GDP growth in China was the result of capital accumulation, supported by an extraordinarily high savings rate which has come to depend increasingly on China's households. Thus, the prediction of the hypothesis of the effect of ratio of total deposit to income is meaningful.

Therefore, the PBC should anticipate the demand for money changes caused by the above features and formulate its monetary policy accordingly.

For future studies, the demand for money is likely to depend upon the exchange rate. It is clear from many other studies of demand for money discussed in Chapter 2 that the introduction of an exchange rate variable improves the model considerably and lead to a stronger cointegrating relationship. In the macroeconomic environment of the world economy, China has made great efforts to absorb foreign capital in order to speed up economic development. This study ignored the influence of exchange rate fluctuations on money demand functions in China is mainly because the Chinese RMB was not freely convertible with other important currencies in the world until 1997. However, future research is needed to analyse the impact of the changes in the exchange rate on the money demand function. Another suggestion for future research on money demand in China might be the studies which include a factor based on the riskness of bonds, as in recent years they are becoming an important asset in the financial portfolio of Chinese households.

APPENDIX 1 – Tables of Chapter 3

Table 1 Total Wage Bill in China 1952-2004 (in billions of Yuan)

Year	Total wage bill	Year	Total wage bill	Year	Total wage bill
1952	6.83	1985	138.30	1996	908.00
1957	19.08	1987	188.11	1997	940.53
1962	25.43	1989	261.85	1998	929.65
1965	28.23	1990	295.11	1999	987.55
1970	34.3	1991	332.39	2000	1065.62
1975	46.35	1992	393.92	2001	1183.09
1978	56.89	1993	491.62	2002	1316.11
1979	64.67	1994	665.64	2003	1474.35
1980	77.24	1995	810.00	2004	1690.02

Notes: total wage bill since 1998 refer to wages of fully employed staff and workers.
Source: China Statistical Year Book (2005) and early issues.

Table 2 Exchange Rates 1952-2004 (year end rate)

Year	yuan /$dollar	Year	yuan /$dollar	Year	yuan /$dollar
1952	2.617	1970	2.4618	1988	3.7221
1953	2.617	1971	2.2673	1989	4.7221
1954	2.617	1972	2.2401	1990	5.2221
1955	2.4676	1973	2.0202	1991	5.4342
1956	2.4618	1974	1.8397	1992	5.7518
1957	2.4618	1975	1.9663	1993	5.8000
1958	2.4618	1976	1.8803	1994	8.4462
1959	2.4618	1977	1.73	1995	8.3174
1960	2.4618	1978	1.5771	1996	8.2982
1961	2.4618	1979	1.4962	1997	8.2798
1962	2.4618	1980	1.5303	1998	8.2787
1963	2.4618	1981	1.7455	1999	8.2795
1964	2.4618	1982	1.9227	2000	8.2774
1965	2.4618	1983	1.9809	2001	8.2766
1966	2.4618	1984	2.7957	2002	8.2773
1967	2.4618	1985	3.2012	2003	8.2765
1968	2.4618	1986	3.7221	2004	8.2767
1969	2.4618	1987	3.7221		

Source: Data of 1953-1987 come from people's bank of China research and statistics dept., (1988, pp 156-157), Data of 1989-2004 come from various issues of international financial statistics of IMF and web www.cei.gov.cn.

Table 3 Financial Deepening Indicators 1952-2004 (in billions of Yuan)

Year	m_0	m_1	m_2	GDP	m_0/GDP	m_1/GDP	m_2/GDP
1952	2.75	9.65	10.13	67.9	0.04	0.14	0.15
1957	5.28	17.81	19.77	106.8	0.05	0.17	0.19
1965	9.08	45.42	49.76	171.6	0.05	0.26	0.29
1970	12.36	59.73	65.11	225.3	0.05	0.27	0.29
1975	18.26	92.3	101.75	299.7	0.06	0.31	0.34
1978	21.2	103.02	115.91	362.4	0.06	0.28	0.32
1980	34.62	153.8	184.29	451.8	0.08	0.34	0.41
1985	98.78	365.91	488.43	896.4	0.11	0.41	0.54
1990	264.44	695.07	1529.3	1854.8	0.14	0.37	0.82
1995	788.53	2398.7	6075.1	5847.8	0.13	0.41	1.04
2000	1465.3	5314.7	13461	8940.4	0.16	0.59	1.51
2001	1568.88	5987.16	15830	9731.48	0.16	0.62	1.63
2002	1727.84	7088.22	18500	10517.23	0.16	0.67	1.76
2003	1974.62	8411.88	21922.68	11725.19	0.17	0.72	1.87
2004	2146.85	9597.1	25080.28	13651.5	0.16	0.70	1.84

Source: China Statistical Year Book (2005) with early issues and PBC website.

Table 4 Real Estate Investment in China 1991-2004 (in billions of Yuan)

Year	Total Fixed assets investment	Real-Estate Development	% to total fixed assets investment
1991	559.45	33.62	6
1992	808.01	73.12	9
1993	1307.23	193.75	14.8
1994	1704.21	255.41	15
1995	2001.93	314.90	15.7
1996	2291.35	321.64	14
1997	2494.11	317.84	12.7
1998	2840.62	361.42	12.7
1990	2985.47	410.32	13.7
2000	3291.77	498.41	15.1
2001	3721.35	634.41	17
2002	4399.99	779.09	17.9
2003	5511.8	1010.6	18.3
2004	7047.74	1315.83	18.7

Source: Data of 1991-2003 come from PBC research (2004, p.191),
Data of 2004 come from China Statistical Yearbook (2005).

Table 5 GDP Per capita in China 1952-2004

Year	GDP (100 Million Yuan)	Population (in million)	GDP per capita (Yuan)
1952	679.0	574.82	118.1
1957	1068.0	646.53	165.2
1960	1457.0	662.07	220.1
1970	2252.7	829.92	271.4
1978	3624.1	962.59	376.5
1980	4517.8	987.05	457.7
1985	8964.4	1050.44	853.4
1990	18547.9	1155.3	1605.5
1995	58478.1	1236.7	4728.6
2000	89403.6	1275.1	7011.5
2001	97314.8	1276.27	7651
2002	105172.3	1284.53	8214
2003	117251.9	1292.27	9111
2004	13651.5	1299.88	10561

Source: China Statistical Year Book (2005) and early issues.

Table 6 Savings Level and Structure (in billions of Yuan)

Year	House hold saving	Time deposit	Demand deposit	Urban	Rural
1978	21.06	12.89	8.17	15.49	5.57
1980	39.95	30.49	9.46	28.25	11.7
1985	162.26	122.52	39.74	105.78	56.48
1990	711.98	591.12	120.86	519.12	184.16
1991	924.16	769.17	154.99	692.49	231.67
1992	1175.94	942.52	233.42	889.21	286.73
1993	1520.35	1197.1	323.25	1162.73	357.62
1994	2151.88	1683.87	468.01	1670.28	481.6
1995	2966.23	2377.82	588.41	2346.67	619.56
1996	3852.08	3087.34	764.74	3085.02	767.06
1997	4627.98	3622.67	1005.31	3714.76	913.22
1998	5340.75	4179.16	1161.59	4296.64	1044.1
1999	5962.18	4495.51	1466.67	4840.46	1121.73
2000	6433.24	4614.17	1819.07	5197.71	1235.53
2001	7376.24	5143.49	2232.75	5994.11	1382.14
2002	8691.06	5878.89	2812.17	7150.48	1540.58
2003	10361.73	6849.86	3511.89	8543.96	1817.77
2004	11955.54	7813.89	4141.65	N/a	N/a

Source: China Statistical Year Book (2005) and early issues.

APPENDIX 2 – Raw Data Set Used in Chapter 4 Econometric Estimations

Raw Data Set

Year	M0	M1	M2	Y	R	P
1952	2.7500	9.6500	10.1300	67.9000	14.4000	100.0000
1953	3.9400	10.9600	11.3700	82.4000	14.4000	102.9900
1954	4.1200	12.2400	13.2400	85.9000	14.4000	105.3600
1955	4.0300	13.2600	14.5900	91.0000	14.4000	106.4100
1956	5.7300	15.9400	17.5000	102.8000	14.4000	106.4100
1957	5.7300	17.8100	19.7700	106.8000	14.4000	108.0000
1958	5.2800	28.9300	31.3200	130.7000	7.9200	108.2200
1959	6.7800	36.0100	39.1700	143.9000	4.8000	109.1900
1960	7.5100	37.1800	40.9100	145.7000	4.8000	112.5800
1961	9.5900	41.0100	43.9800	122.0000	4.8000	130.8200
1962	12.5700	41.0600	43.6200	114.9300	4.8000	135.7900
1963	10.6500	40.7200	43.6600	123.3300	4.8000	127.7800
1964	8.9900	39.7700	43.4700	145.4000	4.8000	123.0500
1965	9.0800	45.4200	49.7600	171.6100	3.9600	119.7300
1966	10.8500	51.9400	56.6300	186.8000	3.9600	119.3700
1967	12.1900	58.0800	62.9700	177.3900	3.9600	118.5300
1968	13.4100	61.6600	66.6900	172.3100	3.9600	118.6500
1969	13.7100	60.9800	65.9200	193.7900	3.9600	117.3500
1970	12.3600	59.7300	65.1100	225.2700	3.9600	117.1100
1971	13.6200	65.3500	71.4900	242.6400	3.2400	116.2900
1972	15.1200	68.5300	75.4900	251.8100	3.2400	116.0600
1973	16.6100	79.2600	87.0300	272.0900	3.2400	116.7600
1974	17.6600	85.0100	93.6800	278.9900	3.2400	117.3400
1975	18.2600	92.3000	101.7500	299.7300	3.2400	117.5700
1976	20.4000	98.4000	108.4600	294.3700	3.2400	117.9300
1977	19.5400	99.5600	110.7300	320.1900	3.2400	120.2800
1978	21.2000	103.0200	115.9100	362.4100	3.2400	121.1300
1979	26.7700	129.1700	145.8100	403.8200	3.9600	123.5500
1980	34.6200	153.8000	184.2900	451.7800	3.9600	130.9600
1981	39.6300	183.8100	223.4500	486.2400	4.3200	134.1100
1982	43.9100	207.0500	258.9800	529.4700	4.3200	136.6500
1983	52.9800	239.2700	307.5000	593.4500	4.3200	138.7000
1984	79.2100	324.5400	414.6300	717.1000	4.3200	142.5900
1985	98.7800	365.9100	488.4300	896.4400	5.4000	155.1300
1986	121.8400	435.2400	626.1600	1020.2	6.1200	164.4400
1987	145.4500	530.8200	766.4500	1196.3	6.1200	176.4500
1988	213.2600	645.2200	928.8900	1492.8	7.2000	209.0900
1989	234.4000	673.8000	1092.0	1690.9	7.2000	246.3100
1990	264.4400	695.0700	1529.3	1854.8	8.6400	251.4800
1991	317.7800	863.3300	1935.0	2161.8	7.5600	258.7700
1992	433.6000	1173.2	2540.2	2663.8	7.5600	272.7500
1993	586.4700	1628.0	3488.0	3463.4	10.9800	308.7500
1994	728.8600	2054.1	4692.4	4675.9	10.9800	375.7500
1995	788.5300	2398.7	6075.1	5847.8	10.9800	431.3600
1996	880.2000	2851.5	7609.5	6788.5	7.4700	457.6700
1997	1017.8	3482.6	9099.5	7446.3	5.6700	461.3300
1998	1120.4	3895.4	10449.9	7834.5	3.7800	449.3400
1999	1345.5	4583.7	11989.8	8206.8	2.2500	435.8600
2000	1465.3	5314.7	13461.0	8940.4	2.2500	429.3200
2001	1568.9	5987.2	15830.0	9731.5	2.2500	432.3300
2002	1727.8	7088.2	18500.0	10517.2	1.9800	428.8700
2003	1974.6	8411.9	21922.7	11725.2	1.9800	434.0100
2004	2146.8	9597.1	25080.3	13651.5	2.2500	444.4300

Data descriptions and sources for Chapter 4

Annual data (1952-2004) is collected from following sources: Statistical Year Book of China (SYBC) and web site: www.stats.gov.cn

M_0 - Currency in circulation in billions of Yuan. Source: SYBC.

M_1 - Narrow money supply contains M_0 plus demand deposits, in billions of Yuan. Source: SYBC.

M_2 - Broad money supply contains M_1 plus time and saving deposits, in billions of Yuan. Source: SYBC.

Y- Gross National Product of China (GDP) in billions of Yuan. GDP is deflated by official price index. Source: SYBC.

P- General price index, 1952=100. Source: SYBC.

R- One year savings deposit rate in percentage. Source: SYBC.

The full Microfit print outs relating to the econometric estimations to chapter 4 are presented on CD-ROM attached to this dissertation.

APPENDIX 3 – Raw Data Set Used in Chapter 5 Econometric Estimations

Raw Data Set

Year	W	POP	UOP	ROP	DEP	DCR	RDG
1952	100.00	574.8200	71.6300	.12000	9.3000	3.3900	0.1400
1953	131.80	587.9600	78.2600	.13000	10.7600	2.7300	0.1300
1954	144.72	602.6600	82.4900	.14000	15.2500	3.7000	0.1800
1955	159.33	614.6500	82.8500	.13000	14.1700	3.5200	0.1600
1956	232.31	628.2800	91.8500	.15000	13.4100	2.3400	0.1300
1957	279.47	646.5300	99.4900	.15000	16.5500	3.1300	0.1500
1958	308.81	659.9400	107.2100	.16000	29.5300	4.3600	0.2300
1959	385.39	672.0700	123.7100	.18000	39.8700	5.3100	0.2800
1960	434.72	662.0700	130.7300	.20000	45.9800	4.7900	0.3200
1961	412.25	658.5900	127.0700	.19000	48.8700	3.8900	0.4000
1962	372.59	672.9500	116.5900	.17000	40.9600	3.8500	0.3600
1963	366.26	691.9200	116.4600	.17000	41.4000	4.6100	0.3400
1964	386.40	704.9900	129.5000	.18000	43.9500	5.4900	0.3000
1965	413.84	725.3800	130.4500	.18000	48.1000	5.3000	0.3000
1966	434.53	745.4200	133.1300	.18000	55.3600	5.1000	0.3600
1967	451.91	763.6800	135.4800	.18000	57.5100	4.7200	0.3300
1968	457.33	785.3400	138.3800	.18000	62.5100	4.6600	0.3100
1969	472.88	806.7100	141.1700	.17000	64.1700	4.6800	0.3200
1970	489.10	829.9200	144.2400	.17000	70.4300	5.7000	0.3100
1971	535.51	852.2900	147.1100	.17000	76.7600	5.6400	0.3200
1972	600.20	871.7700	149.3500	.17000	77.6300	5.1300	0.3100
1973	629.00	892.1100	153.4500	.17000	86.5000	5.2100	0.3200
1974	647.88	908.5900	155.9500	.17000	89.7500	5.0800	0.3200
1975	679.62	924.2000	160.3000	.17000	97.5100	5.3400	0.3300
1976	717.00	937.1700	163.4100	.17000	97.8500	4.8000	0.3300
1977	754.28	949.7400	166.6900	.18000	106.3800	5.1400	0.3300
1978	833.48	962.5900	172.4500	.18000	113.4000	5.3500	0.3100
1979	347.67	975.4200	184.9500	.19000	133.9100	5.0000	0.3300
1980	1131.52	987.0500	191.4000	.19000	166.1200	4.8000	0.3700
1981	1201.67	1000.7	201.7100	.20000	203.5600	5.1400	0.4200
1982	1293.00	1016.5	214.8000	.21000	202.7400	4.6200	0.3800
1983	1370.58	1030.1	222.7400	.22000	277.8600	5.2400	0.4700
1984	1662.51	1043.6	240.1700	.23000	358.3900	4.5200	0.5000
1985	2028.27	1058.4	250.9400	.24000	426.4900	4.3200	0.4800
1986	2433.92	1075.1	263.6600	.25000	535.4700	4.3900	0.5200
1987	2757.63	1093.0	276.7400	.25000	651.7000	4.4800	0.5400
1988	3394.65	1110.3	286.6100	.26000	742.5800	3.4800	0.5000
1989	3839.35	1127.0	295.4000	.26000	901.3900	3.8500	0.5300
1990	4326.94	1143.3	301.9100	.26000	1164.5	4.4000	0.6300
1991	4872.14	1158.2	305.4300	.26000	1486.4	4.6800	0.6900
1992	5773.48	1171.7	323.7200	.28000	1889.1	4.3600	0.7100
1993	7205.31	1185.2	333.5100	.28000	2323.0	3.9600	0.6700
1994	9755.98	1198.5	343.0100	.29000	2932.9	4.0200	0.6300
1995	11873.03	1211.2	351.7400	.29000	3878.3	4.9200	0.6600
1996	13309.67	1223.9	359.5000	.29000	6857.1	7.7900	1.0100
1997	13788.82	1236.3	369.8900	.30000	8262.2	8.1200	1.1100
1998	13816.40	1248.1	379.4200	.30000	9123.9	8.1400	1.1600
1999	14673.01	1259.1	388.9200	.31000	10198.4	7.5800	1.2400
2000	15832.18	1265.8	458.4400	.36000	11607.1	7.9200	1.3000
2001	17573.72	1276.3	480.6400	.38000	15354.0	9.7900	1.5800
2002	19541.98	1284.5	502.1200	.39000	18402.5	10.6500	1.7500
2003	21887.01	1292.3	523.7600	.41000	20805.6	10.5400	1.7700
2004	25082.52	1299.9	542.8300	.42000	24142.4	11.2500	1.7700

Data descriptions and sources for Chapter 5

Annual data (1952-2004) is collected from following sources: China Statistical Year Book (CSYB) various issues and web site www.stats.gov.cn.

W- Total wage index, 1952=100. Total wage index is deflated by the consumer price index. Source: CSYB.

ROP-Ratio of urban population to total population, where ROP=UOP/POP, UOP is the urban population, and POP is the total population. Source: CSYB.

DCR – Ratio of the total deposit to currency, DCR = DEP/M0, DEP is the total deposits. Source: CSYB.

RDG- Ratio of total deposits to GDP, where RDG= DEP/GDP. Source: CSYB.

The full Microfit print outs relating to the econometric estimations to chapter 5 is presented on CD-ROM attached to this dissertation.

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